The Commercial Development of New Products

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The Commercial Development of New Products

by Michael G. Duerr

A Research Report from The Conference Board

Contents

	Page
HIGHLIGHTS	v
WHY THIS REPORT	vii
1. INTRODUCTION	1
2. TAKING TECHNOLOGY TO THE MARKET PLACE	3
Strategic Approaches to New Business	4
Monsanto's Strategy	4
Case Brief: Battelle and Xerography	4
Case Brief: 3M's 'Post-It' Notes	5
Case Brief: Glidden's Entry into Powder Coatings	5
Olin's Strategy	5
Special Development Groups	6
'Targets of Opportunity'	7
A Call from the Boss	7
The Acquisition Route	8
Venture Capitalism	8
Koppers and Kopvenco	9
Brunswick's Venture Capital Program	9
Westinghouse's Strategic Fund	10
3. THE CLIMATE FOR INNOVATION	13
Commitment from the Top	13
Financial Rewards	14
A Piece of the Action	14
Non-financial Incentives	15
Creativity versus Bureaucracy	16
'Informally Structured Smallness'	16
Emphasis on Entrepreneurship	17
3M Revisited	17
Entrepreneurship at Analog	18
'Bootlegging'	18
Checklist for Top Management	19
4. SOURCES OF NEW PRODUCT IDEAS	21
Contributions from Marketing	21
Case Brief: Toledo's Prepackaging Scale	22
Consulting the Customer	23
Customers' Customers	23
Ideas from Commercial Development	23
Technicians to the Field	24
University Research	25
Market Research and Suggestions from Consultants	26
Other Outside Sources	26
Generating Ideas Internally	27

5. EVALUATING AND SCREENING IDEAS—AND BEYOND 29
Screening Criteria 29
Informal Approaches 31
Senior Executives as Traffic Controllers 32
New Product Committees 32
Sequential Screening Systems 34
Screening in the Market 35
Two Examples from Union Carbide 36

6. COORDINATING PRODUCT DEVELOPMENT 37
Case Brief: Glidden's Water-Reducible Liner 38
Case Brief: Streamling for Survival at 'Basichem' 39
Case Brief: 'Machineco's' Marketing Champion 40
Task Forces 40
Case Brief: Signode's Venture Teams 41
Case Brief: 'Pure Products' Hits the Foundries 42
Commercializing New Products 42
Case Brief: Eastman's Bottle Plastic 43
Case Brief: PPG's 'Sungate' Series 44
Troubleshooting 45
Case Brief: Cooperation at 'Waterchem' 45
Case Brief: A Rescue at 'Seagel' 45
Case Brief: Commercial Development at Air Products 46
Commercial Development Units 47
Case Brief: CP on a Shoestring at CasChem 47
Case Brief: Structured Innovation at Dorr-Oliver 48
The C.D. Manager: A Composite Portrait 48
Case Brief: ICI's Fortiglas™ 50
Case Brief: 'Inside-Out R&D' in a Decentralized Company 51
Development as a Line Function 51
Case Brief: Coordinating Development at 'XYZ Pharmaceutical' 52

7. ORGANIZATIONAL APPROACHES 53
Where Product Development Fits 53
What Kind of Function 55
Forms of Organization 56
Transitional Organizations 58
Halfway Houses 59
Case Brief: PQ Corporation and the Brewing Business 59
From Project to Product 60

8. EXPENDITURE AND CONTROL ISSUES 63
How Much for New Product Development? 63
Negotiated Budgets 64
Approvals and Reviews 64
Direct Charges: 'Pro' 64
Direct Charges: 'Con' 65
Cost Center versus Profit Center 65
Case Brief: 'Printchem' Learns to Fly 66
Performance versus Numbers 67

Highlights

This report describes the recent evolution of new product development in U.S. companies and a glimpse of where it stood in early 1986. It also examines the commercial development function, which is found in many companies.

New product development is a two-way street. It entails transforming technology and other forms of know-how to marketable goods and services, and bringing customer needs and ideas for such goods and services back to the laboratory. The importance of these endeavors is underscored by the fact that 35 percent of the companies contributing to this study get at least half their revenues from products they did not make ten years ago.

The principal findings of the study are:

- There is no one "best" approach to new product development.
- There is widespread agreement that it is impossible to plan for technological breakthroughs or innovative exploitation of customer needs. What management can and should do is to foster an environment that encourages creativity and promotes communication within the organization, and between the organization and its customers.
- The chief elements that contribute to success in product development are top-management commitment; giving those responsible for bringing new products onstream their heads; constructive working relationships among R&D, manufacturing and marketing personnel; and careful, constant attention to the marketplace.

Sources of Information and Sample

Information for this report has come mainly from two sources: a questionnaire sent to members of the Commercial Development Association, which garnered 179 responses, and 55 personal interviews with executives whose responses to the questionnaire were particularly interesting. The distribution of respondents by broad industry groups is shown below:

Respondents by Industry

Industry	*Questionnaires*		*Interviews*	
	Number	Percent[a]	Number	Percent[a]
Chemicals	72	40	22	40
Machinery & Industrial Equipment	17	9	7	13
Instruments, Computers, & Electronics	17	9	6	11
Pharmaceuticals, Biotech, & Research	11	6	5	9
Food, Tobacco & Consumer Products	11	6	3	5
Paper, Packaging & Forest Products	10	6	2	4
Metals & Mining	8	4	2	4
Oil & Oilfield Equipment	6	3	2	4
Transportation Equipment	6	3	1	2
Construction & Materials	5	3	3	5
Tire & Rubber	4	2	1	2
Publishing	3	2	1	2
Others (3 companies in telecommunications, 1 in commodities, and 5 that could not be identified by industry)	9	5	0	0
	179		55	

[a]Details do not add to 100 because of rounding.

Why This Report

A recurring issue for most companies in most industries, new product development has gained enhanced urgency in recent years because of technological advances, shorter product life cycles, and growing competition from abroad. The rewards of well-conceived and executed new product programs can be great; the risks of inadequate programs—or no program at all—can be high.

As this report makes abundantly clear, there is no "school" solution to new product development. But by presenting a variety of approaches in a variety of business settings, the report should be helpful to all concerned with this vital means of corporate renewal.

The Conference Board is grateful to the Commercial Development Association for proposing and nurturing this project; to 18 of CDA's member companies for financing the research and the preparation of the report; to the 179 companies that contributed information about their practices and experiences to this inquiry; and to Michael G. Duerr, a highly regarded alumnus of our research staff and now an independent consultant, who carried out the study.

JAMES T. MILLS
President

Author's Acknowledgments

In researching and writing this report I have incurred many debts, which I can only gratefully acknowledge but not repay. The biggest ones are to the 179 executives who completed the research questionnaire, of whom 55 went an extra mile by describing in personal interviews their organizations' approaches to and experiences in new product development.

Thanks are also due to:

- The Commercial Development Association, and particularly the Chairman of its Education Committee, Dr. Newman H. Giragosian, for asking me to take on, and facilitating the completion of, what proved to be an engrossing endeavor.
- Robert W. Reardon, President, Reardon and Associates, who provided the case briefs on "Pure Products," "Seagel," and "Waterchem," and offered his insights on the commercial development process as well.
- Many people at The Conference Board— notably James Greene, Lillian W. Kay, and James K. Brown, and various members of the production staff—who saw to editing the manuscript and readying the text, charts and exhibits for publication.

Michael G. Duerr

Chapter 1
Introduction

As World War II ended, U.S. industry had a virtual embarrassment of riches. Research and development carried on in support of the war effort had produced a host of new substances and processes—some developed to fill a wartime need, others discovered incidentally along the way. Whole new technologies had grown up. On VJ day, industry's cup ran over with new products.

An outgrowth of this pleasant problem was the business function that started in the chemical industry and came to be known as "commercial development." The commercial development executive went out into the market carrying a figurative sample case full of ideas. By talking with customers and prospects, he accumulated an understanding of the potential uses of his company's technologies. By talking with the scientists and technicians in his company's R&D laboratories, he kept up his understanding of the technologies and the substances they produced. By continually communicating with both the lab and the market, he was able to identify, evaluate and coordinate the development of new commercial products.

"CD men" from the chemical companies were the original practitioners of this function. Today, many other industries are represented. This report describes the recent evolution of commercial new product development in U.S. companies and provides a glimpse of where it stood in early 1986.

Although the chemical industry is still home turf for the commercial development function, the problem it addresses has changed much in the post-World War II years. Today, instead of starting with a product and hunting for a good market use for it, the process very often starts with recognition of a market need and then works to fill it using available technology. What has not changed is the need to understand both the technology and the market—the need to build a bridge between the laboratory and the customer.

As the pace of technological development has accelerated, smooth two-way communication between laboratory and market has become more important. This trend has not been limited to the chemical industry. Paper companies, pharmaceutical houses, electronics firms, and, to some extent, machinery, instruments, and even some "smokestack" industries, have been affected. Higher technological content and shorter product-life cycles reward the companies that are fast on their feet. So the function of identifying, screening and coordinating product development has grown in importance—sometimes in companies that paid little attention to it in the past.

Another trend has worked in the same direction. The growth of foreign competition years ago began squeezing the profits of many established U.S. companies selling products that were basically commodities. One of their responses has been to restructure the product mix—supplanting some of the commodities with products of higher value added. Another has been to diversify into entirely new product areas. A third has been to work harder at improving existing product lines—usually adding technical content and striving for faster reaction to changes in the market. All of these responses call for closer and more effective communication between technology and marketing.

These changes did not take place overnight. Conditions changed gradually, and most companies responded slowly and individually. Faced with the need to get scientists, engineers, manufacturing people, marketers and salespeople to communicate, some companies beefed up their marketing departments with technical people; some added marketers to R&D or engineering; some (especially chemical companies, because of their previous commercial-development experience) set up special units to coordinate product development. The size, organization, scope and degree of "clout" that characterize these various expediting groups appear to have been determined pragmatically—depending on how important management believed the problem was and who in the organization seemed best able to solve it.

Most of this report is concerned with describing this array of responses to the problem of developing new products and bringing them to market: different strategic approaches; different ways of encouraging innovation; different ways of identifying and evaluating new product ideas, and of organizing for, and financing, new product development. Individual company responses to this set of problems vary all over the lot. There is no "school solution" to new product development.

Chapter 2

Taking Technology to the Marketplace

In 1951, research chemists at Phillips Petroleum Company in Bartlesville, Oklahoma, were looking for a way to convert light olefins to high-octane gasoline components, using a chromium-promoted silica alumina catalyst. In addition to the expected products, they observed a white solid material collecting in the pyrex effluent separator. The unexpected material turned out to be polypropylene in crystalline form.

Further experiments with the catalyst disclosed that it converted ethylene into polyethylene—but polyethylene of higher density than the conventional polyethylene then being made. Further, the conversion took place at much lower temperatures and pressures than those required in the conventional process.

Convinced that it had found something worth pursuing, Phillips devoted very large resources to follow up the discovery as rapidly as possible. By 1954, pilot plant studies had progressed far enough to begin to design a commercial process. In 1955, a 1,000-pound per day semi-works unit, scaled down from the commercial design, went into operation under Phillips R&D. Until December 1956, when the first commercial high-density polyethylene plant went on stream, Phillips used 300 to 400 people on the project—for lab research, engineering, applications research, and market development. The profits earned after 1956—from sales of high-density polyethylene and from world-wide licensing of the process—proved that Phillips' decision to invest so much in following the trail that began with the unexpected white solid in the separator was a sound one.

Other sparkling examples of scientific breakthroughs enliven the annals of commercial new product development.

- Two framed patents in the name of Jack Kilby hang in the reception lobby at Texas Instruments, Inc., in Dallas. One (dated 1959) is for the integrated circuit. The other (some five years later) is for the hand-held calculator.
- The serendipitous discovery of aspartame in 1965 (when research scientist James Schlatter licked his finger and found he had been working with something sweet) propelled G. D. Searle & Co. onto a new and rapid growth curve.

The Battelle and 3M case briefs on pages 4 and 5 illustrate how imagination and persistence—both inside and outside the research lab—can produce a new product winner.

Breakthroughs like these xerography are glamorous, potentially revolutionary, and very profitable. But they are rare. Furthermore, they are unpredictable and often hard to recognize when they occur. The consensus of scientists and executives interviewed for this study is that they can not plan for breakthroughs. What they can do is strive to create an environment that encourages creativity, and promote enough communication within the company to assure that someone will recognize the value of a breakthrough if one should take place.

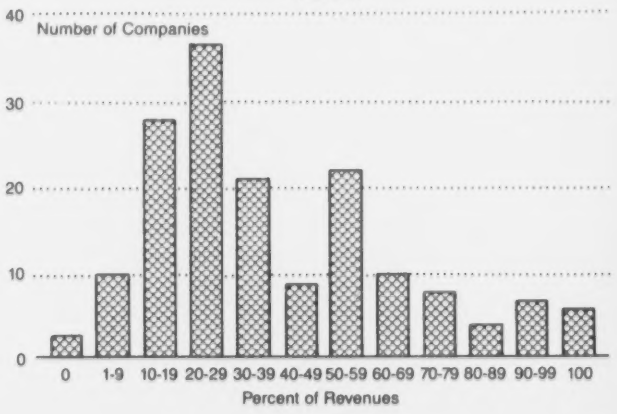
Chart 1 gives a rough indication of the importance of new product development. About 35 percent of the executives cooperating in the study say their companies get at least half their revenues from products that were not in production ten years ago. Companies at the high end include some new high-tech firms with high proportions of sales spent on R&D, but they also include established firms with less research spending. The reason becomes clear from interviews.

Most commercial development is not concerned with breakthroughs nor with abrupt breaks with traditional core businesses. Product improvements and line extensions—the

Chart 1

Company Revenues from Products not in Production Ten Years Ago

(N = 163)



"meat and potatoes" of new product development—occur continually. They account for most of the development effort and, by their sheer volume, for most of the profits.

At Glidden Coatings & Resins, a Division of SCM Corporation, about 80 percent of the R&D is devoted to product improvements and line extensions; about 20 percent is geared to new technologies (see case brief on page 5) and products emanating from the research organizations. And executives of many other companies make the point that their research effort goes almost entirely for product improvements and line extensions.

Quite often, companies that feel the need for new technologies apart from their core businesses do not ask their R&D labs to develop them. They go outside the company and buy them—either by acquisitions, minority investments, licensing, or hiring people who have the knowledge and skills they seek. Most of the cooperating companies make very little use of the acquisition route. But those that do make extensive use of this method—for almost one out of five companies, acquisitions accounted for more than half the new products introduced over the past ten years.

Strategic Approaches to New Business

A company's decision to enter a new business usually is preceded by much planning and study, although some companies carry out the planning and study more formally than others. This report suggest that the degree of formality is not very important: Equally satisfactory results have flowed from two-year staff studies and from seemingly arbitrary "strategy memos" from the chief executive officer. The common denominator seems to be a clear understanding of the company's capabilities and limitations and a clear statement of the direction the company wants to take.

For the first century of its life, the PQ Corporation dealt primarily in sodium silicate. A closely held company, PQ felt little need for product diversification until the early 1970's. When it did turn its attention to development, PQ found fertile ground.

The first Corporate Development Group proceeded in two directions: (1) acquisitions and (2) a forward integration strategy, developing new businesses from sodium silicate derivatives—silica gels, silica sols, precipitates, zeolites.

Since sodium silicates are a relatively mature business, with many larger firms already active in the field, PQ approached the market very selectively—methodically looking at each derivative market to identify a small segment in which it could carve out a competitive advantage. PQ identifies a promising segment of the market, takes a prototype into it, gets customer feedback, makes a business assessment, and determines what it can do. When the new niches are of sufficient size, it makes each one a separate business unit.

Monsanto's Strategy

Monsanto Co.'s emphasis on new business development stems from a strategy developed informally by its top management team. A classical chemical company, Monsanto saw its growth rate cut in half by events of the late 1960's and 1970's. The oil shock kicked feedstock prices up, reducing the value added by Monsanto on its basic lines. The chemical industry as a whole became a media target as the ecology became more and more a matter of concern. Regulatory pressures raised costs and slowed development. Growth at Monsanto dropped from twice the rate of the gross national product in the early 1960's to just about the same rate as GNP growth in the late 1970's.

Monsanto's response was a deep study of where it was going and how it could improve its prospects. Through this study it identified three kinds of businesses: (1) businesses it did not want; (2) those it wanted to continue, while finding ways to run them better; (3) businesses it wanted to get into for the future.

In the first group, the company decided it did not want products close to natural feedstocks, because of the low value added. In the second group are core businesses that must be continued to provide the income stream to finance the shift to the most promising businesses for the future. Monsanto will "sustain" and "nurture" these businesses, looking for new opportunities in the core fields. This means focusing on a flow of new product ideas that build on the

Case Brief

Battelle and Xerography

In the mid-1930's, Chester Carlson, a patent attorney, got the idea for a dry copier, using an electrostatic process for reproduction. He built a crude machine and went around knocking on doors. The machine was large; the copies were poor. Some 20 companies, including Eastman Kodak, turned it down.

He came to Battelle, where several key people sensed the invention's potential and decided the process was "a good research gamble." Battelle invested some money in it, got a good patent, and licensed it to Haloid—predecessor to the Xerox Corporation—which had its back to the wall financially. As a result, Xerox came to Battelle saying it needed capital but could not afford to pay royalties. Would Battelle accept stock as payment? Battelle would.

Xerox's marketing people realized that a $15,000 price tag for its first commercial machine would limit sales drastically, so they decided to lease the machines—collecting rental plus 2¢ or 5¢ a sheet for the copy paper. World War II had instilled a "copy consciousness" in people; when the machines were available, people rapidly found new uses for them, and xerography took off—enriching Battelle as well as Xerox.

The technology was unique; and it came along at the right time; and Battelle's scientists did good work developing it. But an equally important "invention" was Xerox's decision to lease the machine rather than sell it. That was the stroke that lies behind the success of xerography.

Case Brief

3M's 'Post-It' Notes

In the early 1970's, one of 3M's polymer chemists was trying to make a strong latex adhesive, suitable for use in the automobile and construction industries. He modified a substance to give it different properties and discovered a weaker adhesive that did not transfer from one surface to another. It was patentable and interesting, but what to do with it?

The chemist elicited some mild interest in it around the company as a substitute for cork board. But when the artificial cork boards were hung, they collected dust and lost their adhesiveness. Also, the whole market for cork boards was small. At this point, the chemist tired of the project and went to work on something else.

In 1974, another scientist, who sang in his church choir, used a bit of the adhesive on slips of paper to mark pages in his hymnal. The idea of selling notepads smeared with adhesive occurred to him. He worked up some cost figures and a market survey was made asking people if they would pay X-amount for these pads. The answer was a resounding "No." Still unconvinced, he made up some pads and they were test marketed—just to see if they would sell if the customer had a chance to try them. They did not move.

Despite three failures, the champion had accumulated more "believers." More pads were made up and samples were widely distributed. In a short time, people who had been given the pads began coming back for more. Once the pads got into people's hands, they found a multitude of new uses for them. The "Post-It Note Pad" was born.

Case Brief

Glidden's Entry into Powder Coatings

Back in the 1970's Glidden hired two chemists who were assigned the job of getting the company into a new technology. They chose powder. (Powder coating, which resembles talcum powder, is applied to a part electrostatically, then baked at moderate temperatures until the particles flow together to form a finish. The system is pollution-free, energy-efficient, and virtually eliminates waste.)

The Vice President-Research & Development recognized the value of such a technology and designed a program to support its investigation and development. The chemists were sent to a powder coating plant in Germany, which was formerly owned by Glidden and which was supplying powder to European finishers. The chemists familiarized themselves with the manufacturing process and returned to develop their own technology.

The Vice President—R&D was convinced that he had a winner, but he knew that he would have a tough time convincing top management, because the process of making the paint was quite different from making liquid paint and would require a new plant. To make powder manufacture more acceptable to management, the chemists tried to make the powder like liquid paint, then sprayed it into an evaporation chamber and cycloned out the flecks. The experiment was not successful.

From 1971 to 1974, the Vice President—R&D used some of his research budget to set up production facilities to make powder in the conventional way—by extrusion and pulverization. He used a contract manufacturer in one part of the country to melt and extrude the coating and another toll manufacturer in another part of the country to reduce the extruded coating to fine particle size, screen it, and package it. By 1974, market managers expressed some interest; but the R&D budget provided virtually all the money and drive behind the development.

In 1974 Glidden built its first powder line in Huron, Ohio; then moved production to Charlotte, N.C., when Glidden acquired the Celanese powder business in 1977. Today, powder is the fastest-growing segment of the coatings industry—and Glidden is the leader.

technologies and marketing capabilities of existing business units.

In the third group, the leading business is biotechnology—the chemistry of living systems, or protein chemistry. Here Monsanto found itself well positioned in plants, with its leadership in herbicides; fairly well placed in animals, through feed supplements; but not so well placed with respect to humans. Although its research included human-health drugs, it had no "delivery system" for human-health products.

Recognition of this strategic gap in its plans for the future led Monsanto to acquire G. D. Searle. By adding Searle as a free-standing entity, Monsanto not only picked up Searle's earnings stream but also gained additional human-health technology and a functioning marketing and sales system in an important area where it was weak. Eventually Monsanto's own biotech R&D probably will be merged into Searle.

Olin's Strategy

In 1982, Olin Corporation recognized that its core businesses in chemicals and metals could not serve as a long-term basis for continuing growth in profits. So it spent five months and many man-hours drawing up a corporate strategic plan for 1983-1992. This planning effort gave a realistic assessment of the earnings potential of the existing businesses. It also identified three high-growth areas for Olin: (1) electronics materials and services, (2) defense, and (3) water management.

During 1982-1984 it placed primary emphasis on electronics materials and services: because Olin was already familiar with the electronics industry as a supplier; because it called for the Olin mix of chemical and metal technologies; because it would provide a vehicle for international expansion (which Olin sought); and because, at first blush, the growth rate looked good—at a real 8 percent plus per year.

Olin's first step was to appoint a task force and an executive steering committee "to figure out what we didn't know." These groups worked for a year, developing a broad information base about the electronics materials and services business and helping several echelons of managers (including the CEO) to gain an understanding of the new business.

The company deliberately passed up the short cut of employing consultants because it wanted to force on itself the experience of thorough learning. "Taking the time to come down the learning curve resulted in a far better strategic plan than if we had forged ahead immediately," Olin's Senior Vice President for Corporate Planning and Development reports.

After a year and a half of broad planning and study, Olin was ready for the next step. It formed a new group, called Electronic Materials and Services, and charged it with developing a strategic plan for the thrust into the new field. EM&S's planning effort took another six months, involving all functions and all organizational levels. The EM&S Group did hire consultants to help curtail internal biases during the planning process.

During Olin's period of education, the opportunity presented itself to buy Phillip A. Hunt Chemical Corp., the world leader in imaging chemicals. It was too good an opportunity to pass up, Olin decided. By undertaking a crash study to understand the photo-resist market and technology—along with the usual evaluation of an acquisition candidate—it decided the acquisition made sense. "Hunt was the cornerstone we needed on which to build the electronic chemicals side of the business," an executive reports. Olin bought the offered 64 percent of Hunt in 1982; the rest in 1984.

The completed plan identified target areas and resource requirements—capital, R&D, people, organization. It also specified methods of implementation—including acquisitions, technology purchases, minority equity purchases, joint ventures, venture-capital strategies, and internal development. Olin's executives feel that the total elapsed time—two years—was well spent. Without the early education and consensus building, they say, the subsequent implementation of the plan would not have moved as quickly nor as smoothly as it did.

Special Development Groups

As will be detailed later, several of the companies cooperating in the study, on recognizing the need for redirection toward new businesses, have established new departments to find them, assign priorities, and start developing them. In one chemical company a New Products Group was set up to steer the company into new businesses based on polymer technology. The group leader was told to start with a clean slate, and not to concern himself with product-line extensions or new applications of existing technology.

With these clear marching orders in mind, the leader studied the literature on product development and then started by scanning likely future markets based on three criteria: (1) growth, (2) technology turnover—how long has the technical base for current products been in place? and (3) profitability of the participants in the market.

On the basis of this market study, the group selected three product areas as most promising:

(1) Electronics materials, for both integrated circuits and printed circuits. The group looks for 20 years of good growth curves in this market, based on the continuing attempts to "cram more on a wafer"—which means the material must be cleaner, with better consistency, capable of accepting (or laying down) sharper lines.

(2) Health-care materials, such as new dressings, based on continually rising demand for something better.

(3) Agricultural chemicals, because of the technological turnover to biotechnology. The whole market may not grow, but change within the market will produce good growth in segments.

Project managers were then assigned for each product area (two in electronics, one for integrated and one for printed circuits). To each project group were assigned one or more research, market development, applications development, and marketing people. Members of each project group are not on loan; they are permanently assigned. Its mission is not just to study markets; it is to develop new products. Several new internally developed polymer products are now approaching commercialization, and the leader of the New Products Group is beginning to examine outside sources of technology.

Pennzoil Products Company took a different approach. In the early 1980's, its management concluded that more new products were needed to sustain growth. Its Technology Division was restructured, and laboratories were relocated to The Woodlands, Texas—nearer marketing and management people in Houston. In late 1984, Pennzoil Products created a small development unit, which by mid-1985 consisted of four professionals and a secretary. The unit was headed by the former Director of Corporate Planning, and reports to the President.

Most of the new product development had been done in the operating units. The problem was that divisional executives were kept so busy with day-to-day operating concerns that they had little time and few resources left for product development. Now line extensions and improvements are still left to the operating units; the development unit devotes most of its attention to developing new products and new businesses. Its time is divided this way: (1) finding brand-new business ventures—50 to 60 percent; (2) supporting product-line extensions in the divisions—20 percent to 30 percent; (3) coordinating acquisitions and divestments—10 to 30 percent.

A marketing-driven company, Pennzoil Products develops new products to capitalize on its customer contacts and distribution channels. Technology can be built from within, or acquired, or licensed, or hired. The development unit has identified areas of good growth potential and close fit and

is analyzing ways to get into these businesses. Rust prevention is one of the areas under investigation: What is the best strategy for entry? What product areas: coatings? rust-prevention chemicals? services?

The product-line extension work at Pennzoil Products is illustrated by the recent introductions of REGANE, an antiknock gasoline additive; STEAM, a nonflammable exterior engine cleaner; STEAM ENGINE SHINE, an engine protector; and AIR SUPPLY, a premium non-flammable tire inflator. These products build on themes of protecting, cleaning and safety and are related to the established line of GUMOUT carburetor cleaners and fuel additives.

'Targets of Opportunity'

By no means all shifts in strategic direction are founded on exhaustive evaluations of the industries to be pursued.[1] When Amstar Corp. (formerly American Sugar Refining) decided to diversify out of commodities, it aimed for 50 percent of sales in other lines by acquiring going concerns with steady earnings streams. Outside of that, Amstar's acquisitions have little or nothing in common—hoists, power tools, circuit breakers, power supplies, radio frequency switches, military radio receivers, tungsten carbide, quartz crystals, and the machines for polishing them.

Often a "target of opportunity" presents itself to the top management of a company that feels the need for new products in promising areas, and is promptly snapped up without much study. The opportunity looks sound, and too good to miss. In 1982, Standard Oil of Ohio moved onto a fast track with the acquisitions of Dorr-Oliver Inc. and E. Keeler Company.

Dorr-Oliver is a leader in fluidized bed technology, an efficient method for combustion, incineration and minerals processing by suspending solid fuel in a bed of air. Keeler is a leader in steam-generation boiler design using solid fuels. The union of these two firms combined two technologies essential to leapfrogging ahead in the quest for an environmentally acceptable way to burn, as fuel, various types of pollution-producing materials and waste products (see case brief on pages 48-49).

American Cyanamid Co.'s entry into the metal-coated fibers business is another example: When opportunity knocked, Cyanamid acquired a firm with the requisite technology, moved that firm's technical people into a Cyanamid plant, and built on the acquired technology, using its labs to attain a higher level. At the same time, Cyanamid built a marketing and sales force from scratch. A Cyanamid official explains the adventure in these words: "The technology is unique. We *knew* the market would go for it."

[1] For a study of companies changing their strategic focus, see James K. Brown, *Refocusing The Company's Business.* The Conference Board, Report No. 873, 1985.

A Call from the Boss

In some of the responding companies, strategic direction of the new product effort is provided directly by top management. At one chemical company, there is no formal strategic-planning system. The CEO or the president decides on a theme area for research. It may be based on high-level conversations inside or outside the company, consultants' recommendations, popular articles, gut feelings, or a combination of all of these. He sends down a memo, and the corporate and division business development and marketing people set about finding ways to get into the area. An example:

The president decided that high-tech ceramics would be a good growth area, and made this conviction known in a planning document. He encouraged the corporate acquisitions group to shop around. At the same time he told R&D: "Within one year I want to be in high-tech ceramics. Go out and hire the best people in the field, and get started."

Since then the company has made several acquisitions and has hired a staff of top quality researchers in ceramics. It identified ten acquisition candidates and narrowed the list to six before finally making firm offers. The acquisition route was chosen to gain instant market access and knowledge that otherwise would have taken years to acquire. R&D planners have turned attention to finding the best ways the new technology can contribute to corporate profits.

Top management at Brunswick Corp. wanted a capability in electronics, "to learn the language." After shopping the available acquisition candidates, the CEO decided that all their price/earnings ratios were too high. So Brunswick bought 10 percent of an electronics systems house, then invested three times the purchase price in helping the company develop.

The venture has had mixed results. It developed a video console that displays information carried on an optical disc—a promising idea, Brunswick felt, but a bit ahead of its time. It also adapted some bowling-control equipment to run a cold header, to make screws and nails from stock by hitting twice—once to heat, once to shape the head. Brunswick now owns 45 percent of the venture, and has accomplished its original mission. "We've learned electronics," says an executive, "and cheaply, given the size of our investment."

Ideas from the top have helped other companies into profitable new businesses. Meredith Publishing Co. developed its Better Homes & Gardens Realty subsidiary because top management asked what else it could do with the *Better Homes & Garden* name that would not hurt it—and because the Vice President-Product Development had a brother who was a realtor in Tennessee. The same marketing question has spawned a new core-business extension: a New York friend of Meredith management proposed a chain of local-focus magazines, beginning with *Houston Home & Garden* and *Dallas Home & Garden.* Meredith provides the name and the money; the partner provides the management. Together they built on a small existing base in Houston and Dallas and now plan a chain of local-focus *Home & Garden* maga-

zines all across the country. Meredith holds 50 percent, in the role of knowledgeable investment banker.

The Acquisition Route

As examples cited earlier indicate, acquisitions have found favor as a vehicle for entry into new business areas. Though buying a successful company can be expensive, it has the often important advantage of speed. Developing needed technology, smoothly functioning distribution, and experienced manpower takes time. A properly executed acquisition yields instant positioning and market share.

Olin is well pleased with the results of its Hunt Chemical acquisition. Since then, it has acquired several other firms, to "broaden our offering of chemicals, conductive coatings, and alloys." The common denominator is "new technology which can benefit from Olin's financial, R&D, and marketing resources."

Olin stresses the importance of fit. An executive urges that a plan for fitting the two operations together is necessary before an acquisition is made. Each of Olin's acquisitions, he says, "has filled a particular need for which a plan exists to grow the business within the framework of Olin's Electronic Strategic Plan." He warns: "Synergy is an overused word in the acquistion business; and true synergies are fleeting. All acquisitions are different: Force fitting all acquisitions into a generalized mold will likely result in casualties."

Other companies cooperating in the study echo these warnings, but acquisitions remain a popular source of new products in fields not closely related to the existing core businesses. Bird Inc., a Massachusetts machinery maker, estimates that less than 25 percent of its new products come from R&D. The rest are from acquisitions, licensing and joint ventures.

One specialty chemicals producer has found that "taking a small position in a technology window has not proven to be very successful"; but acquisitions and larger participations remain important parts of its strategy for growth. Now it is putting together a "collaboration" with a European biotech firm—applying biotech to waste-water treatment. The Europeans have the technology; the U.S. firm has the marketing and sales in place. The form of the venture has not yet been determined, but both parties are convinced of its value and both are learning from the relationship—which may make the collaboration worthwhile regardless of the final outcome.

Venture Capitalism

Another quick route to new technologies seems to be gaining popularity in the 1980's, although it has been in use for some time: taking a minority interest, either directly or through an independent venture capital firm, in new ventures with interesting inventions and helping them through their developmental stages. Such investments can also prove to be self-liquidating, or even turn a profit. From the viewpoint of the large corporation, it is attractive to consider the idea of laying out $50,000 to $100,000 for a little equity in a promising new venture. With five or ten ventures for $500,000 the chances are that two or three will succeed well enough to pay for the others.

Westinghouse Electric Co.'s corporate-planning group recommended in 1980 that the company study the venturing process. Westinghouse invested in a venture-sponsoring firm "to learn the culture." The foray into venturing was successful: Now the group is investing for Westinghouse and has a portfolio of a dozen ventures—all treated by management at arm's length. The idea has spread from the corporate level into some of Westinghouse's business units. For example, the Nuclear Group is involved in a venture at the University of Tennessee to eliminate human error in interpreting radiographics for quality assurance.

Independent venture groups are financing organizations that invest in new businesses at the earliest stage of their existence. The tax law in effect through 1986 made it attractive for them to buy these incipient ventures, ride with them for their first three or four years, and then sell at a profit to companies looking for products of assured feasibility. This arrangement worked fine for the venture groups, since their profit was a capital gain. It worked fine for the corporations, too, because it stimulated the flow of inventions and ideas toward the marketplace. The venture groups were constantly foraging for inventions. The corporations could do this themselves, of course; many of them are in better condition to absorb some losers than are the venture groups. But corporate bureaucracy tends to be conservative: Individual managers can not afford to sponsor a "turkey."

Koppers and Kopvenco

Koppers Co. stands out among the companies that are participating in venture capitalism. Through its subsidiary, Kopvenco, Inc., Koppers seeks out and takes minority positions in fledgling ventures with promising technologies. Sometimes Kopvenco deals with a venture-capital group; sometimes it skips the middle man and deals directly with inventors.

Kopvenco grew out of the realization that Koppers was heavily entrenched in mature industries and that something new would be needed to sustain future growth. In the late 1970's, a Corporate Research Committee came up with a three-pronged strategy to solve the problem: (1) stepped-up R&D at corporate level, (2) sponsorship of potentially interesting university research, and (3) support for fledgling companies developing promising new technologies.

The third initiative resulted in the formation of Kopvenco in 1981. By 1985, Koppers had invested $35 million and bought into fourteen companies—two holding companies and twelve direct investments in technologies including computerized drafting, robotics, ceramics, refractories, and the life sciences. Kopvenco is "interested in most everything," hoping that it may fit into a core business or, perhaps, become one. It is not interested primarily in portfolio investments, but it has participated in them at a profit, just like

the independent venture capitalists it goes into partnership with.

From the beginning, Koppers management set two basic objectives for the venture capital effort:

(1) To gain windows on technology that might lead to the strengthening of Koppers's technological base; and

(2) To make a return on the venture-capital investment.

Complementing these objectives, the Kopvenco board has established some general ground rules:

(1) Investments generally would not be made in consumer products.

(2) Investments generally would not be made in product areas requiring extensive government regulatory approvals.

(3) Kopvenco would pursue investments in the fields of microbiology or genetic engineering, with particular emphasis on the prospects of specialty chemicals.

(4) Kopvenco would pursue investment opportunities in advanced material sciences, such as ceramics, and other possibilities involving distinctive characteristics.

(5) Investments would be made in the general area of productivity-improvement technology.

(6) Some of Kopvenco's funds would be placed in other limited-partnership venture-capital companies to diversify its base and to learn from association with professionals in the field.

(7) Investments would be made in start-up companies or in early round financings of high-tech companies.

(8) Generally, Kopvenco would seek a 20 to 30 percent equity position and a seat on the investment company's board, although exceptions would be acceptable at times.

No specific target for return on investment was set, but according to a spokesman, "we did feel that we should do as well as other venture-capital companies which have demonstrated from 20 to 30 percent return on investment after taxes."

The "windows on technology" sought were expected to benefit Koppers over a long period of time as a result of Kopvenco's experience in evaluating for investment purposes hundreds of high-tech business opportunities and from interacting with the scientists and managers of companies in which it would invest. The association would permit Koppers to glean technology benefits not only from rubbing shoulders with these groups but also by licensing from them, entering joint ventures as appropriate, and possibly buying them out—*"after* reasonable assurance that the technology has major profit potential, and *before* the monetary cost has reached a level that is likely to prohibit satisfactory return on our further investment."

Kopvenco's *Statement of Purpose* concludes:

"The window on technology purpose, to succeed long term, must be supported (or led) by the second major purpose of making a satisfactory return on investment. There must be a way to evaluate and measure Kopvenco's performance that is more than subjective. Selling stock that has appreciated in value and has the benefit of lower capital gains tax provides this mechanism. Because there will be failures as well as successes, the evaluation should be averaged over a four- to five-year span. This purpose will insure more effective evaluation of investment opportunities, and better monitoring and helping hands in nurturing investments toward success."

Kopvenco is a profit center, run out of the Corporate Planning group. The Vice President, Planning, is Chairman of Kopvenco; and other members of Planning work at it, charging time to it as appropriate. Other people at Koppers also charge time to it; and its revenues come from dividends and charges against the ventures. An Assistant to the Vice President, Planning, devotes the most time, acting as first screener for prospective ventures. He reads about 30 proposals per month — "of which 20 percent are worth a good look, and 2 percent are forwarded to the Kopvenco board for consideration as an investment."

Kopvenco tries to have a partner (or partners) with long-term interest in the venture and, as noted, representation on the venture's board. But it plays a passive role whenever possible and encourages each venture to maintain its identity.

Monthly reports on the ventures are received. If something looks bad, Kopvenco will go to the head of the group and make a recommendation: It can only suggest. At worst, it can call other long-term-interest partners and question whether to join in the second or third round of financing, but so far it has had little overall conflict. "After all," a Kopvenco executive notes, "the knowledge base is at the other end."

Often the ventures come to Koppers for advice. Sometimes Koppers technology can help; sometimes someone from another Kopvenco venture can solve the problem at hand. Since Koppers is a rather loosely structured company, this informal style of management suits all concerned "Especially in venturing, structure kills," a Kopvenco executive says.

Chart 2 (on page 10) shows the growth of similar programs from 1981 to 1985. Of the 61 captive corporate programs in place at the end of 1985, 50 were said to be strategically oriented; the other 11, to be ROI-driven.

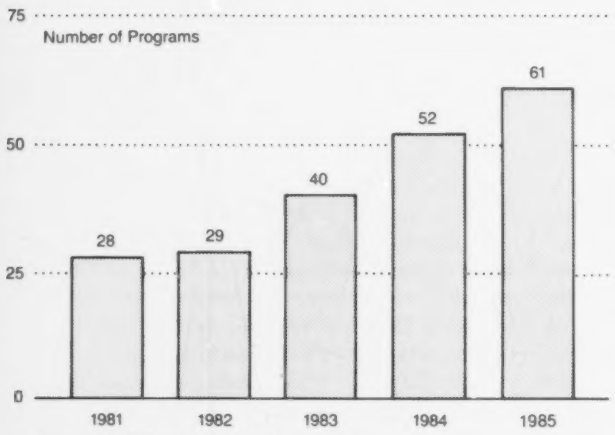
Brunswick's Venture Capital Program

Brunswick Corp. runs its Venture Capital Program through highly autonomous operating divisions. Concern over new-business development has grown from the realization that the divisions must add high-growth product lines if the company is to prosper. The CEO says that he expects the divisions to grow at a rate that would be impossible without new products, and he has also made it clear that he expects them to achieve this growth through acquisition of businesses or promising technologies. In return, Corporate provides aid—both financial and advisory—for the divisions.

The leading edge of this development effort is the internal Venture Capital Program. Begun in 1982, the program operates under the direction of a group of senior corporate

Chart 2

Captive Corporate Venture Capital Programs



Source: Venture Economics, Inc.

executives with expertise in technology, finance, administration and planning, who act as an internal board of directors. At the working level, the program is orchestrated by the Vice President—Technology; but it is carried out by the division managers with corporate assistance. An example shows how the program works.

Brunswick's Vapor Division serves the railroad industry in the United States and Canada, and the Division Manager has been asked to submit a proposal for a new communications system. He wants $100,000 from the Ventures Program to finance a year's pre-proposal work.

The Division Manager outlines the idea to the CEO and also to the VP—Technology, who alerts the rest of the Venture Board. The Board makes a recommendation, which the CEO usually follows.

If the request is approved (as in this case it was), corporate funds are made available to the division and the division manager carries the ball from there. Even if the Board should vote "no" and the CEO should follow its recommendation, it does not kill the proposal: All it does is deny the corporate funds requested, but the division can go ahead anyway.

All costs associated with the Venture Capital Program are funded by corporate, in recognition that some ventures will not be commercially successful. For internal measurement purposes, there is no impact on the short-term profit goals of the division. This encourages the division managers to take some risks in their pursuit of new products and new businesses, which is the CEO's main objective.

Although the development work is carried out in the divisions, many of the ideas for ventures flow into Brunswick through the corporate VP—Technology. With a small staff, but a wide circle of contacts, this VP finds and investigates ideas before turning them over to an appropriate division. An example is Enhanced Energy Systems, now a venture in the Valve & Control Division

EES had its start in the mid-1970's, when the Department of Energy contracted with Sandia Laboratories to develop a system of tertiary oil recovery that would not pollute the air. Scientists at Sandia tried injecting high pressure air, water and oil down the well. Combustion took place underground; and the heat and combustion products were absorbed deep in the earth, enhancing oil recovery by heating and by pressure of the absorbed gases. "Operation Deep Steam" was conducted in wells at Long Beach, California. When it reached the point where they knew it would work, a group of scientists launched their own firm, with financial backing of an independent venture capitalist. The firm had almost run out of money when this came to Brunswick's attention. The VP—Technology first went to Sandia, to ensure that it had no objections and to check the qualifications and standing of the inventors. Then he approached the inventors, offered assistance, and brought them to Brunswick in exchange for 49 percent of the stock. Under the Valve & Control Division, EES now is in the initial stages of commercialization, selling steam at the well under contract. Brunswick believes this to be a viable business, in spite of fluctuations in oil prices.

The Venture Capital Program takes the place of corporate research, and seems to be particularly well-suited to a company with virtually autonomous divisions. Instead of telling the divisions what to do, corporate headquarters encourages innovation by helping to pay for it.

The Venture Capital Program seems to be working: One division has three ventures in progress. The *1984 Annual Report* states: ". . . future growth demands that a company continue to seek new opportunities through new technology while fostering an entrepreneurial spirit within its operating managers. To this end, Brunswick will continue its Venture Capital activities in 1985 and the years beyond as an investment in its future."

Westinghouse's Strategic Fund

Some venture programs are internally oriented. In the late 1970's, Westinghouse recognized that its efforts at new product development were not producing the desired results, so it decided to experiment with venture entities. Corporate Resources set aside a strategic fund for use in generating these ventures. Two ventures have products on the market now.

The first grew out of research conducted for a business unit. The Defense Center was doing hybrid circuitry work, involving inspections made under a microscope. The technicians had to look away from the microscope to write down inspection data, which were then fed to a key-punch machine. To save time and work, they needed a way to communicate their findings to the computer by voice.

The Defense Center first looked outside of Westinghouse, but found the software very expensive; so corporate R&D was asked to invent something to solve the problem. Already well along the learning curve in voice technology, Westinghouse R&D devised a hierarchical software package that permitted an operator to use the software in a short time.

Comparison with competitive outside systems convinced Westinghouse that its system was better.

There had been no marketing contribution up to this point and none of Westinghouse's business units had the market covered, so a venture was set up. It rented space away from the R&D laboratory in the Allegheny County (Pennsylvania) Regional Development Corporation's industrial park, hired marketing and manufacturing people from Westinghouse and from outside, and now has a headcount of about 25. Fortunately for the project, the engineers who developed the technology have proven to be "venture types." Much of the manufacturing is done outside by subcontractors, with final assembly and quality control done back at the industrial park.

Westinghouse owns the venture; the entrepreneurs have no stock. A "board of directors" composed of Westinghouse executives supervises it, and it works to a mutually agreed set of goals for specified periods. By conforming to the goals, the venturers earn a cash bonus amounting to "a significant fraction of their annual salaries." According to one of the directors: "They work their heads off—acting more like entrepreneurs running their own business than bureaucrats."

The second venture was financed from the outset with money from the strategic fund. It involves a microcircuit that permits control of the electrical loads in a building by data transmitted over low-quality transmission lines. Knowledgeable building owners save money by keeping their electrical demand just below the level where they would have to pay a higher rate. Other systems on the market can control a building's air conditioners, lights, fans and other loads in this manner; but they require special wiring.

The business unit already serving the building-owner market "owns" 49 percent of this venture. The business unit is designing its switches, circuit breakers, and other products to be compatible with the new control system. The venture is fully staffed, does its own marketing—highly targeted to sophisticated building owners, either for new buildings or for redesigning old ones. The venture is now operating successfully. Costs of the system are such that two-year payback for the building owner is not uncommon.

These are the only two ventures now on the market, but many others are being debated; and Westinghouse is creating institutions to bring forth more in the future. In normal product development, Westinghouse executives note, as do executives in many other companies, success is correlated with how much communication takes place between the technical people in R&D and the marketing people in the business units. Ventures seem to produce much more of this interfunctional communication than the normal projects of the BU's, because with many ongoing products, BU managers must devote most of their energies to keeping operations profitable. In the venture, the new product is the only thing going. The venturers benefit from smaller size, greater concentration, and greater motivation.

Chapter 3
The Climate for Innovation

What elements make up the right climate for innovation? The questionnaire asked the study contributors about factors associated with success in new product development and conditions that would encourage it. The results are summarized in Charts 3 and 4. In the interviews, executives stressed the points covered in the rest of this chapter.

Commitment from the Top

Many of the companies that are most confident about the new-product-development programs (and seem to be enjoying a good deal of success) start off by describing their chief executive officer's commitment to developing new business. The CEO's role at Brunswick's Corp. has already been noted (pp. 9-10). At Bell & Howell, the chairman and president travel to plants and sales offices for breakfast meetings with employees, establishing an open forum for exchange of ideas. Management encourages the employees to explore new ways to improve their products through risk taking. A full-scale internal communications program spreads the same word; and efforts are being made to bring engineers and marketing people together for day-long meetings to talk about what the customers want. A tough climate for obtaining support for innovation has been replaced by the statement from top management: "Find a market need and meet that need."

As noted in the case brief on page 41, Signode launches its new-product-development teams with a ceremony, presided over by the CEO. Top management is visibly committed. The CEO's message to the whole company: "I'm committed to developing new products; the board's committed. We are putting money in it; we are watching."

The climate for innovation at American Cyanamid Co. is likewise set by the CEO, who says that Cyanamid is a "research driven" company and backs it with generous funding year in and year out—even when there is a downturn in business. If an important research program in one of the

Chart 3

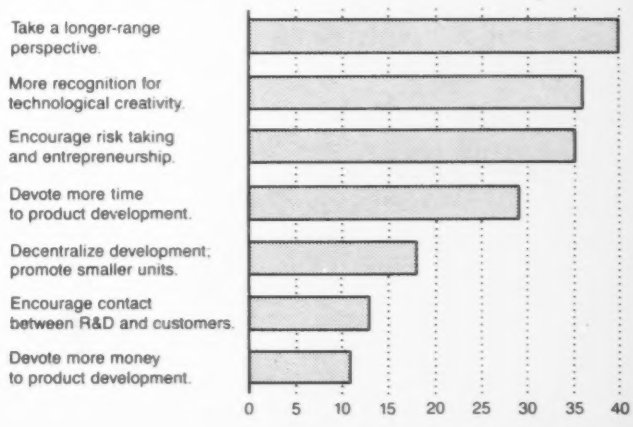
Factors Associated with Success in New Product Development

(N = 179; multiple responses)

Chart 4

Conditions That Would Encourage New Product Development

(N = 151; multiple responses)



groups is abandoned, he wants to know why; and it is understood in the groups and divisions that new products are expected. Once or twice a year, division and group managers get together with top management to talk about promising developments—new and ongoing— at their levels. Managers in the divisions know they can not drop a development project without an explanation to division, group and, ultimately, to top corporate management.

And the Marketing Vice President of a consumer products company with a strong commitment to new products notes: "I have never seen the CEO so much as snicker at an idea that was unorthodox—maybe even a little off the wall."

Financial Rewards

In a large majority of the companies cooperating in this study, there are no special rewards for new product development and no strong feeling that any are needed. It is considered to be part of the job. "It's a team effort, so how can you reward one person?" asks a new products manager at Eastman Chemical Products Co. Since Eastman has a merit system of salary increases, good work is likely to be rewarded; but there are no bonuses for innovation.

Another executive offers this explanation of why bonuses are rarely tied to new business development: "Sometimes the CEO will say: 'I want 20 percent of sales from new products!' And then we all sit around and argue what is a new product."

Nearly all companies have incentive-bonus schemes, but very few tie them directly to new product development. Typically, a manager who does an exceptionally good job introducing a new product will qualify for an incentive bonus, but the bonus will be awarded for outstanding performance — not necessarily for development work.

A few respondents report that they have designed their sales-compensation plans to favor new products. A coatings manufacturer arranged it so that a salesperson making $30,000 a year selling the traditional product line could get twice as much supplementary income by landing a new account in a new line than by getting a comparable new account in an old one — an increment of $10,000 rather than $5,000.

A recent internal study at one plastics company has upgraded the status of new-business-development people. It is now considered a "development assignment," a promotion route; and grade and salary levels have been upgraded, but no specific bonuses reward new product development.

Line managers' compensation is being adjusted to encourage new business development. Until the last year or so, managers' goals were not tied to "growing the business," but were totally determined by the current budget. Now the remuneration program includes an element for the proportion of sales in "new markets developed over the last three years." One executive expects progress in this direction, but slowly. He believes operating managers should be measured by standards including "today" and "tomorrow" business results in a ratio of 60-40 or 50-50. The formula would depend on the business, but it might include: percent of sales in new markets, number of new products introduced, or a requirement to bring product out on time. In one competitor company, he says, a manager must generate 15 percent of sales from new products to get a bonus.

Campbell Soup is one of the handful of companies that have established special programs to reward creativity and innovation. Campbell's President's Awards for Excellence encourage creative problem solving both in process improvement and in product development by teams and individuals at all levels — from R&D professionals to blue-collar workers. In 1985, 18 awards (a silver bowl and $2,500) went to employees all over the world. One innovation increased the salmon harvest of a Campbell unit by 30 percent; another used power-plant waste water to heat tomato greenhouses; a third improved the process used in boning chickens, saving $90,000 in one plant. The Ogilvy Award (a cash bonus) goes annually to the business unit that has "displayed the greatest creativity." The Rex Budd Agency of the Year Award goes for the best performance by a Campbell advertising agency.

A Piece of the Action

The incentive with the most appeal to new product "champions," executives report, is "a piece of the action." In venture capital programs, and in a few small companies, ownership is the main motivator.

In one such firm, a chemical company, the manager bluntly stated: "If you are going to develop a new product for us, we are not going to give you a raise or a promotion. We are going to *make you rich*!" More specifically, he adds that this could take the form of stock, or alternatively, a cash bonus — "10 percent of everything that comes in the door." In another small company, the business development manager is happy in his work, but he is driven by the expectation that the project he is moonlighting will come in and "make me a millionaire."

When Brunswick put together its venture with the inventors of Enhanced Energy Systems (page 10), EES remained a free-standing business with majority control (51%) by the inventors. If the inventors had to come to Brunswick for additional capital, however, Brunswick's share would increase — causing a change in control. That is what happened, as expenses mounted and the "energy crisis" eased. At this point, Brunswick's VP-Technology noticed a distinct change. When the partners lost equity control, their enthusiasm waned.

Sometime in 1986, the partners may be back in position to buy equity; and then Brunswick must work out a formula to rebuild their stake, to keep them interested in driving the venture forward with its early vigor.

In another company whose climate for innovation has been improved by an uncharacteristic foray into free-wheeling product development, the principal developer would like to see a better reward structure for innovation than the one in

place. At present, pride of workmanship, public recognition, a $35 coupon good for a dinner for two at a local restaurant (awarded every six months) for recognized achievers, plus merit raises and normal promotions, are just about all the incentives there are. He would like to see stock options contingent upon performance — or equity given to key employees — if projects could be established as separate companies. "But it's hard to break from tradition," he says.

Non-financial Incentives

Executives cite many non-financial motivating factors that call forth the innovators' best efforts. One of these innovators is highly placed in his company and is allowed plenty of freedom to operate. Pride, "the thrill of the chase," the regular incentive program motivate him. There is no special incentive plan for innovation, and he does not need one. He *does* wish that he could convince management to pay higher salaries to the commercial development people who work for him. Their jobs require line as well as staff skills, especially if the "champion" goes on to become a product manager. He would like to pay them more, but he says nothing about an incentive scheme. If his "young soldiers" are left free to wheel and deal, get regular raises, and can see a promising career ahead of them, they will work effectively.

New product people in many companies enjoy an *esprit de corps* that comes from knowing that they are on the cutting edge of the corporation's future. And top managements successful in innovating try to promote this spirit whenever they can. Monsanto chooses "the brightest and best" people for its product development teams.

An executive of Signode Corp. says that he measures the chances for success of a development team by the loudness of the screams from their bosses when individuals are pulled away from their regular jobs and assigned to the team. He looks for the best people not only because of their competence but also because top management will pay attention to their work. (See case brief on page 41.)

A number of companies have attempted to turn on the entrepreneurial spirit of their middle managers by letting them carry new product developments all the way from inception to commercialization and beyond. The idea is that these product champions will earn their rewards by becoming division or business unit managers for the products they have developed. Often, this works well; but there is a kind of person who loves the thrill of innovation and yet feels out of place in administering the business of manufacturing and selling a product.

For this group of people, Analog Devices, Inc., has invented the position of "Division Fellow." This title permits an engineer who has no interest in operations to move ahead in compensation, privileges and prestige at a rate comparable to a line manager. A Division Fellow has vice presidential status; but he remains an engineer—working as an engineer and monitoring young engineers.

The Ultimate Motivator

One commercial development manager tells of a product champion who began innovating in earnest when top management abruptly decided it did not really want to get into the business he had been working on for several years. Realizing that he was about to lose his job, the champion searched frantically for a new application for the technology. When he announced that he had one, nobody really believed it, but everybody thought he deserved at least a chance. One year later he was at the pilot stage with the product. At that moment, a competitor came out with a similar product. Suddenly the champion was back in business. His "innovation by desperation" was recognized as an opportunity. "Full speed ahead!" management told him. The champion was compensated, but his real motivation was fear for his job.

Bringing R&D people in contact with customers has helped provide motivation at a chemical company, where tangible incentives are sparse. At first some of the researchers were reluctant, a development executive explains, "but we sent them to call on customers as soon as they had something to show. Soon most of them enjoyed seeing the practical side of their work. It helped drive them—their motivation being pride in their work. It s become a broader job than previously defined: to develop a polymer and then go out to customers to evaluate it."

It is this identification with the job at hand that gives the "product champion" system its clout. At one machinery company, for example, a promising new technology failed at its first introduction due to lack of motivation. Nobody drove it and it went nowhere until a champion rediscovered it and provided the drive that had been lacking. When the technology was reintroduced, he badgered R&D to simplify the machine, saw to it that the salesforce was trained, and focused marketing on the one application that would be the easiest to sell.

The champion was driven by interest more than money. Neither he nor the salesforce were given any financial incentives.

Most often, the climate for innovation seems to be very closely related to the set of conditions that make it possible for good people to exercise their talents—drawing on corporate resources for the tools they need and for occasional special assistance, but mainly just let alone. The corporate environment, after all, has little in common with Thomas A. Edison's laboratory in Menlo Park; and not many Edisons work for corporations. Although many research executives would like to have a "pot of gold" to reward excellence, the most common motivation in this group of companies is the satisfaction of a job well done.

"Nobody does research to earn a golden test tube," snorts one executive. And another suggests: "If you do it right, it's your job; if you do it wrong, it's your ass."

Creativity versus Bureaucracy

A number of executives say that innovation and administration do not mix. "Creativity takes time; it's hard work," an R&D Director asserts. His company recently reorganized along functional lines. In the process, he was given charge of two engineering divisions in addition to R&D. Where he used to have lots of time to think, now he tries to squeeze such activity into 20-minute blocks of time. Creativity, he feels, requires an atmospere of "quiet, mind-stimulating, barely controlled chaos—uninterrupted by other responsibility."

Others note that programs designed to promote entrepreneurship in the corporation can cut both ways. A new-product-development manager explains that since his company changed its approach, permitting him to carry a development project all the way to full commercialization and beyond, his own attitude has changed. "Now I think like a general manager—with a more practical frame of reference and much more concern for the bottom line," he says. "What worries me is that the new system may dry up the development of new concepts."

A "non-hierarchical" atmosphere is an important part of the climate for innovation, according to many executives. At Campbell Soup's brainstorming sessions, "everybody takes off his sergeant's stripes at the door," the U.S. Division President says. In selecting product champions, enthusiasm and desire are more important than seniority and rank. As a result, a one-year assistant marketing manager took a new dry-soup product from concept to market with little or no interference from veterans; and a six-months' marketing MBA brought frozen microwave soups to test market.

Campbell pushes the non-hierarchical message even further—suspending senior executives over a tank of water at the company picnic, where employees may give them a dunking by hitting the target with a baseball. No other companies reported this touch, but several have scrapped their executive dining rooms and redesigned office space to throw workers and managers into closer contact.

To demonstrate his company's participative style, a marketing vice president reports that the president often bawls him out; the two argue vehemently; but they synergize. He says: "We both can change our minds. A new idea will not be thrown out because it doesn't fit preconceptions."

By contrast, several other companies are described as overly stiff and formal by executives who have worked for them in the past. Often they illustrate the point with a remark about the accessibility of the chief executive. "At the Such-and-Such Company, I used to have to arrange a week in advance to see the president. Here I can just walk right in," says one. Another says: "My counterpart at So-and-So Company couldn't even recognize his CEO when we passed him on the street. I met the guy at a meeting once, and I call him by his first name."

And a third: "The X Company had an autocratic management style—full of management fetishes. The need for 'consensus building' placed great emphasis on internal politics. If you gave my boss there a choice, between spending an hour with his number-one customer or at an internal political meeting, he'd choose the internal meeting every time."

Several take aim at "committees, where you need 20 signatures before you can get a new product development off the ground." And one describes a "Catch 22" that until recently stifled development efforts at his company:

Before a new product could be appropriated enough capital to produce it, the board of Directors had to approve an appropriation request signed by the corporate vice president for operations and the vice president for sales. As a matter of policy, the VP-Sales would not sign until a product-line manager agreed to sell the product and gave him a written estimate of sales and profits. This meant, in effect, that the idea had to be embraced by the product-line manager before the product could be produced in saleable quantities. Not many new products were developed, because it was very difficult for a product-line manager to adopt a product that had never been sold and had no proven customer base.

'Informally Structured Smallness'

Some of the more successful innovators among companies that cooperated in the study are relatively small. Far from being a drawback, small size seems to encourage the kind of internal communication and the swift response to customers needs which spawn new products.

The executive of a small plastics company attributes its rapid growth to an ability to concentrate on its customers. "People are thrilled to find a supplier that wants to help them, or even to listen. Most plastics companies are so big they can't serve small markets—it's economically prohibitive. When customers find a supplier that's willing to serve a small niche, they're happy to pay top dollar."

Other, somewhat larger, companies have responded to rising competition by narrowing their lines of business to concentrate on niche markets. One paint company, for example, first dropped its architectural paint business to concentrate on its industrial lines; then further narrowed its focus to high-solid coatings for metal furniture, abandoning other market segments.

Some of the largest companies achieve the same result by organizing themselves into small, semi-independent units. As one research executive puts it, a company should strive for "informally structured smallness."

The Manager, Strategic Planning, of Texas Instruments Inc. defines that company's organization as "many small businesses imbedded in a corporate resource base." The focal points of TI's operations are Product Customer Centers, comprising the marketing, technical and manufacturing staff needed to create, make and sell products. In a sense, each PCC is a task force, with organization changing in response to need and a life that runs as long as the product is made. About 90 percent of the product development takes place in the PCC's.

Waters Chromatography Division of Millipore Corporation is a $180-million technology business involved in liquid

chromatography. In the early 1980's it reorganized its marketing and business development efforts in an effort to encourage innovation and facilitate the implementation of the best ideas. It formed special project teams, called "business units," to develop new products both inside and outside traditional business areas.

Although these units can be flexible in their size and composition, depending on the task they set out to perform, Millipore pays particular attention to the corporate environment in which it operates. "Our objective is to provide business units with a sufficient amount of freedom to be entrepreneurial and successful, while not disrupting the normal operations of the company," an executive explains. This requires management, as well as motivation. He lists six rules for ensuring their effectiveness:

(1) Establish the legitimacy of the business units. They report directly to the Vice President—Marketing, and have consistent and conspicuous support from top management.

(2) Establish the need for them throughout the company. Invariably the units will cause some disruption, so it is important that those inconvenienced both understand and support the concept.

(3) Establish a support structure that is responsive to the needs of both the business units and the rest of the business. The interfaces between functions must be managed and supervised carefully.

(4) Establish a detailed plan. What is expected? From whom? By when? The plan should also indicate the assumptions it is based on, and at what point those assumptions can be evaluated.

(5) Establish a monitoring and review process for each business unit. In large organizations, especially, it is important to specify accountability and have an accurate conception of progress.

(6) Establish a cooperative environment. The support structure must work for the new venture in addition to supporting the business as a whole. Overlapping measurement criteria—double credit for success—help the support structure share in the business unit's success, but not at the expense of its other responsibilities.

Emphasis on Entrepreneurship

For a company to cash in on its fertile climate for creativity and innovation, somebody must thrive on it and accomplish something. And behind the buzz words "champion" and "entrepreneurship," something is being accomplished in many of the companies studied.

In small companies, entrepreneurship is what the company is all about. BioPlastics Inc., of Cleveland, has developed a continuing succession of new products in its six years of existence. It has had to. Its stock in trade is a proprietary process for bonding plastic to webbing—useful in many applications from missile transport to harness and tack for horses.

BioPlastics' new products are not very different from the old ones, but are tailored to meet specific customer needs. Because it is such a small company, the same people go out and talk to customers and then come back and design the products. If the first design does not work, the same people will be on hand to see why and then to design the "second generation."

On a considerably grander scale, this is what went on at Phillips Petroleum in the 1950's, when top management bet the company on high-density polyethylene, and again in the 1960's with the discovery and development of the Ekofisk field in the North Sea. A small top-management group decided on a course of action to follow and plunged into it, convinced that they were making the right choice—or at least willing to bet on it.

3M Revisited

In most large and well-established companies of the mid-1980's, such behavior is not the order of the day. Entrepreneurship, though fashionable, wears a different costume. But it is still encouraged in *Fortune 500* companies. 3M Corp. does not develop a new product until it finds a champion, and then does not abandon the effort unless the champion "gets tired." (See case brief on page 5.) The company thinks of its development projects as "incipient divisions." Top management's role is sponsorship, protection, financial encouragement, and a degree of insulation for the champions — and a corporate target that "in any given year, 25 percent of sales should come from products introduced within the last five years."[1] As long as the product champion (project manager) retains enthusiasm, he will continue to get support. The size of the company can be very helpful as the champion draws on its resources and its collective experience, but the initiative for a project comes from one person alone.

The keys to success, 3M executives say, are the entrepreneur's sense of security and freedom to use the company's resources. By "security" they mean that the champions do not fear failure. There is a saying around the company that nobody goes anywhere at 3M until he has "failed" once or twice. The champions with good success records tend to move up in the company faster, but if a project dies, no one goes around asking: "Who approved that one?" There are no witch hunts; and the champion is guaranteed another chance.

When someone working in a 3M laboratory gets an idea that fits somewhere else in the company, it is usually easy to transfer it to a division where it may fit. If the idea is not picked up by an existing division, the champion can make use of the Genesis Program.

For example, a lab worker in the coated abrasives division gets an idea for a way to raise the output of light bulbs. 3M does not make light bulbs. In some companies, the idea would

[1] James K. Brown and Lillian W. Kay, eds. *Corporate R&D Strategy, Innovation and Funding Issues.* The Conference Board, Report No. 863, p. 10.

be dropped. At 3M, if the scientist is convinced there is something worthwhile, the idea can be written up—an explanation of the "what" and "why"—and submitted to the Genesis Program. This brings the idea before a board of scientists who, if they think it is worthwhile, may provide a budget account of $50,000 for the year to try it out. At the end of the year, if real progress is shown, the board may fund another $50,000. Meanwhile, the champion remains assigned to the old division and continues to do the old job.

By the end of the first funding year, 3M hopes someone in the company will have taken an interest in running with the idea. ("I'll call on GE; maybe they'll have a good fit.") But even if the second year passes without the idea having caught on, the champion may still divert 15 percent of available time to the project—regardless of what his or her supervisor says. The purpose is to avoid losing good ideas because a supervisor is not interested. And, by extension, to avoid turning off the entrepreneurial instincts of the men and women who work for 3M.

Entrepreneurship at Analog

Another company that has succeeded in tapping its employees' entrepreneurial instincts is Analog Devices, Inc. (Norwood, Massachusetts), a manufacturer of integrated circuits and testing equipment. At Analog, all research and product development work is done in the divisions. Ideas come "from all over the division"—engineering departments, marketing, sales, customers. It is up to division marketing to decide what is commercially feasible, what is particularly exciting, and to assign priorities to items in this pool of ideas.

Lab technicians and engineers work closely with marketing. Typically, an engineer comes up with an idea and works on it until he is not sure where to go with it next; then he asks marketing. When marketing can no longer help make a choice with confidence, it asks a few key customers.

R&D people are encouraged to spend 10 percent of their time working on ideas that have not made the priority list established by marketing. Since Analog always has five to ten times as many ideas as it can pursue, this gives the person at the bench a chance to work on personal ideas if he thinks marketing and engineering management have made a mistake.

For product ideas that do not fall neatly into the regular chain of command, Analog uses champions and task forces, but not in the usual way. Champions are never assigned; and task force members seldom. When a champion emerges, it is spontaneously. Typically, such product developments grow from "back burner" projects. When the champion emerges, he develops a business plan, outlining the need for personnel and facilities, and tries to fill these needs by going around the company convincing people to help with it. Nobody is transferred or told to work on a task force, and there is no organized venture program at all.

When the idea attains enough stature, the champion tries to sell it to the division's general manager. (General Managers at Analog are easy to reach, so he probably has already heard about it informally.) If the GM thinks the idea will fit the product line and make money, he will authorize support up to budget capability. But the initiative rests with the champion. If the GM thinks it will not fit the product line and does not want to pursue it, the champion may then take it to Analog's CEO.

The CEO, an entrepreneurial type himself, may authorize corporate support or—as has happened at least once—may finance the development personally if corporate resources are short. Once he did this and his faith was rewarded by a successful product—which he then sold back to the company.

'Bootlegging'

Several of the companies cooperating in the study report—with a touch of irony—that some of their profitable developments have been carried out with no authorization from top management. And many others build a provision for "bootlegging" into their management systems.

For years, Bell & Howell was a small factor in the then

Nurturing and Retaining Entrepreneurs

By definition, entrepreneurs are people whom it is hard to keep in the corporate fold. The adventurous personality that drives a development ahead despite all obstacles is hard to identify and encourage, and even harder to keep. None of the participating companies has a test that picks the champions out of the group. One executive says: "You don't look for champions; you just watch for them to come out of the woodwork."

As noted earlier, a free and open climate, recognition for achievement, and support for the work are helpful in encouraging entrepreneurship. 3M recognizes two career paths for its champions: Some go on to become division managers; others are "recycled" to pick up other ideas at an early stage and drive them until they are ready to become established businesses.

"There's room for both kinds of people," an executive from another company suggests. "Some are oriented to service—to helping others, taking their place in society, and reaping the rewards. Others are more interested in solving the problems, seeking the answers. People in the first group become line managers; those in the second group will lose interest in operations and yearn for the challenge of research and development."

As for keeping entrepreneurs on the payroll, an executive of Analog Devices is philosophical. In his view, a company probably can not do anything to keep entrepreneurs in the corporate fold. If they want the opportunity to make their own way, they are going to go. Giving them the opportunity to do their thing tends to be an encouragement for them to stay, and so are recognition and money; but nothing guarantees it. He says: "Even if you create the right climate, you may lose them. If you don't, you *will* lose them." He doubts the climate can be made more attractive than it is at Analog, but it loses some anyway.

modest videotape duplicating business (500,000 to 1 million tapes a year), volume was growing slowly, had not amounted to much; so management decided to withdraw. The champion in charge dragged his feet, then went to work in earnest promoting a joint venture with Columbia Pictures. Columbia needed large quantities of tape at short notice, to capitalize on the demand for movies that were currently "hot" sellers; Bell & Howell's champion needed a big increase in volume to justify staying in the business. The deal was struck, and the venture became the leading producer of videotapes in the world.

An executive tells of the researcher at his firm who came up with a piece of "new generation technology" and convinced his division manager of its great promise. The division manager gave the researcher some money and time to develop it. As more money was needed, however, the division manager asked for help from the group president. The group president found it "a great idea, but we can't afford it."

Several people who had been helping with the project on a part-time basis were reluctant to scrap it. They took it to a few key customers. Working at the customers' laboratories—and aided by continuous feedback—they gradually designed, tested and *made* the product in secret. At that point, the key customers went back to the inventor's firm and told its CEO how impressed they were with the new product. All the returns are not yet in, but the executive reports: "Now we can't spend money fast enough on this project."

Checklist for Top Managment

The numbers in Charts 3 and 4, when combined with the thoughts expressed in the interviews, plus actual corporate practices, all add up to a message on what top managements can do to create a good climate for innovation. The message:

"If you really want a successful program of new product development, your commitment to it is what we need the most. Your commitment must be vocal, meaningful and continuous.

"It helps if the lines of authority are clear-cut and control is decentralized. Innovation and development will flourish best if the work is done by a small, enthusiastic unit working on a long leash. Ideally, it should be led by a self-driven product champion, working under the CEO's protection and drawing support from wherever in the company he needs it.

"This means establishing an atmosphere that encourages risk taking and rewards entrepreneurship. A big budget is not needed, but it helps if financial controls are not too tight. Sometimes a little timely cash from the CEO's 'slush fund' can do more good than a larger sum pushed through the budgeting process. Formal incentive programs—monetary or nonmonetary are not required but recognition of good work is. So is allowance for the failures that are an unavoidable part of any product development effort.

"As thrilling as a technological breakthrough may be, recognize that most of the successful new product developments will come in products closely related to the ones we are selling already. The best way to promote success in these developments is to encourage better communication: inside the company among all disciplines and functions, but especially between R&D and marketing; outside the company, with customers—and especially between our technical people and the customers' technical people.

"Finally, resist the urge to measure development activities by their immediate impact on the quarterly P&L. Find better ways to measure them: This may mean performance milestones in the strategic plan, instead of financial measurements. It may involve unorthodox approaches. And it requires patience."

Chapter 4
Sources of New Product Ideas

The companies providing material for this study spread a broad net in their search for new product lines. The survey questionnaire presented a list of sources of ideas (Chart 5). Only three of the 179 respondents checked one source of ideas; several checked all ten possibilities. And the personal interviews gave further emphasis to the point that new product ideas spring from many sources.

The interviews make it clear that the contributions of both the marketing and the technical people are vital every step of the way from the inception of the idea until the product hits the market. The interviews also pointed up a distinction that does not show on the chart—the distinction between the relatively rare "breakthrough" invention and the much more common product improvement or product line extension.

Most new product ideas come from the market. Nearly all of them are closely related to an established core business—maybe an improvement in an existing product; maybe a new product that extends an existing product line; maybe, in some mature industries, a new and cost-effective way of making an existing product.

The best source of these "market driven" product ideas is, of course, the customer. Even at Battelle Memorial Institute (Columbus, Ohio), whose activities center around research rather than production and sales, an executive insists that the ideal way to develop new products is to "invent to a need." He urges:

"Don't come to us—as many new-product-development people do—and ask what we have in our portfolio. Come and tell us: 'We need this, this and this.' Probably we'll say that we don't have it, but let's see if we can find it. The new product people should have good lists of needs that jibe with their companies' existing lines."

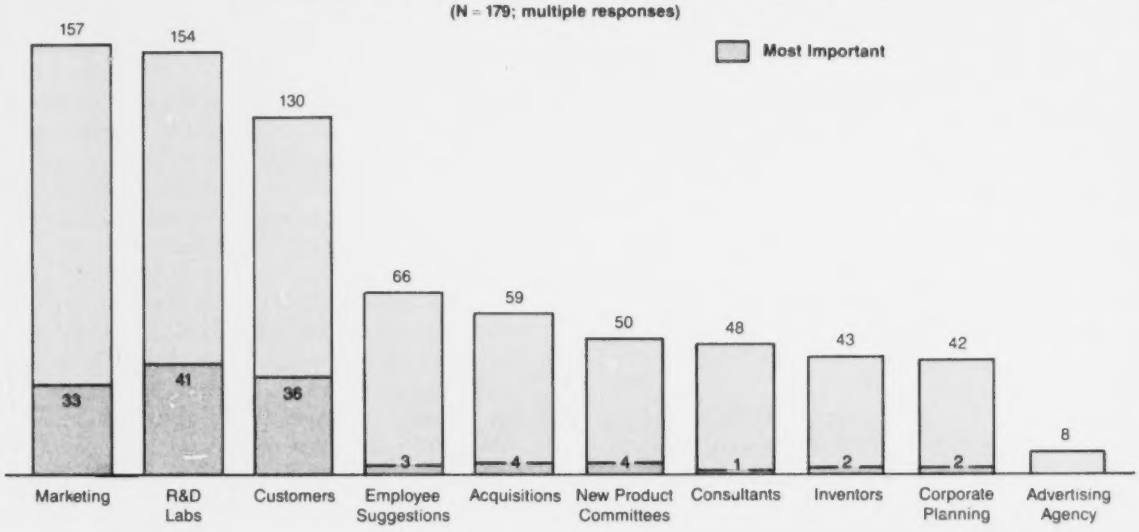
Contributions from Marketing

Although some new product ideas come in from salespeople who learn of them in the course of calling on customers,

Chart 5

Where Companies Get Ideas for New Products and Business Ventures

(N = 179; multiple responses)



Case Brief

Toledo's Prepackaging Scale

In early 1977, customers of Toledo Scale's retail product group—food processors and food stores—identified two problems with Toledo Scale's prepackaging scale then in use. Salespeople reported them to engineering.

(1) The label printers used 300 mechanical slugs of a type which the customer had to change manually for different kinds of product.

(2) Since no printer could handle random weight-scanning codes, a second label with the correct UPC bar code had to be applied to the bottom of the package.

The demand in the market, as relayed by the sales reps from delicatessens and supermarkets in their territories, boiled down to getting rid of the type slugs and putting the scanning code on the same label.

Two men, one from engineering and one from marketing, were asked to look into the problem in addition to their other duties. Both were given broad latitude as to the number of hours they could charge to the project. If necessary, each would lay the project aside until he could get back to it: Over an 18-month period, the engineer put about 25 percent of his time on the prepackaging scale, and the marketing man, about 33 percent.

First, they went on the road and talked with salespeople and customers, homing in on the specifications for a machine that would be welcome in the field. Gradually they filled in detail (e.g., label formats). They learned that the scale would be better received if it could handle more information; so they replaced the 300 slugs with a memory for 4,000 items. Many customers said that the machine must be able to communicate with a computer; so they talked to computer manufacturers to learn the details of how to make a scale communicate with a computer. After 18 months (and much travel) they had come up with a document specifying what the machine should do, and with realistic expectations that it could be made, and with some idea of costs.

At that point, they presented the project for management approval and funding. Management approved it all the way to production, with three check points along the way. The criteria included: Can we build it for so many dollars? Can we service it? Does it do what it is specified to? Have the field tests been successfully completed? When they could answer each of these questions, they were instructed to report back to the Engineering Steering Committee, composed of the General Manager, the Director of Engineering, and the Director of Product Marketing. At these meetings, management had a chance to look at the project from a broader perspective and to ask pertinent questions.

After another year, the project reached the third check point and was ready for pilot building. Initially the company made 50. It placed 25 in each of two sales regions, with back-up people to explain, maintain and service. (There were not enough people to cover more than two regions adequately.) When the 50 new prepackaging scales were welcomed in the market, Toledo went into full production. In July 1979, the new product was introduced at a major trade show.

the study suggests that the sales force may be an underused source. Eastman Chemicals Division reports that some good ideas come in from sales representatives, but mostly in the fibers division, where customers frequently comment on their product needs. Several companies' new-product executives consider their salespeople to be insufficiently qualified for this task, and several from industrial goods companies point out that nobody can learn anything significant about customer needs without getting past the purchasing agent.

An executive who has made a study of Japanese companies' efforts to capture U.S. markets says that the use of their sales reps is an area in which they have "stolen a march on us." Japanese sales reps are trained in gathering intelligence, he says. "It's not that they cheat or steal secrets; they just keep their eyes and ears open and ask good questions during their calls on customers." Equally important, Japanese management has a smoothly working system for processing the information the sales forces gather—making sure that it gets to the people who can use it.

Several of the companies cooperating in this study have made an effort to train their salespeople in new product work. A member of Toledo Scale's New Product Advisory Team emphasizes an indirect approach: "You can't learn much by asking the customer what it wants in the way of a new product. You ask the man in the back of the supermarket who's prepackaging meat how the job is going, and he says: 'Fine, but I'm sure tired of picking up all this meat.' So you think about how to make it easier for him—with a conveyor, maybe."

The members of Toledo's team lose no opportunity to evangelize as they carry on their regular jobs. They screen ideas from sales, pick up information to identify opportunities themselves, and go back for more details as needed. See case brief above.

In companies that do not have special product-development units, the role of collecting and evaluating intelligence gathered by the sales force usually falls to marketing management. A step back from the trenches, the marketing executive is seen by these companies as the best qualified to understand the salesforces' reports and translate them into effective corporate responses. Sometimes marketing people call with the salesreps, sometimes they make parallel calls.

At one machinery company, for example, needs and ideas typically come in from the sales force to division marketing, where the needs are defined more precisely, the opportuni-

ties are reviewed, and a business plan takes shape. Marketing ascertains what kind of product is called for, its market potential, what price it can command, its likely production costs, and, finally, the potential profit it will generate. Then, if the division manager bestows his approval, product development begins. (See case brief on page 22.)

In consumer products companies and in some industrial products firms that are "marketing oriented," this coordinating role for the marketing executive causes few problems. As the technical content of the company becomes more important, though, marketing's role changes. Liaison with R&D and engineering becomes more important in new product development, and marketing is not so often seen as the focal point for collection of new product ideas.

Consulting the Customer

Many executives who cooperated in the study report successful ways of consulting with customers to introduce their ideas into product planning. "Ninety-nine percent of our ideas come from asking customers," says an executive of BioPlastics (see page 17). "You have to ask them. They rarely tell you if they're unsatisfied; you just lose them." A few examples of BioPlastics's unspectacular, but successful, ideas:

(1) For horse tack, stitches (which sink into leather) rest on the surface of plastic-coated webbing and abrade each other. Modification: Change the dies to provide grooves for the stitches. (2) Where the strap edges abrade each other, change dies to add a bead on the edges. (3) Add transverse corrugations, to make a strap wrench. (4) A dozen customers expressed a wish for reflective dog collars: After some experiments, BioPlastics is testing reflective strap with those customers and a few others.

In the course of improving its own plant facilities, Monsanto developed some good ideas for control room instrumentation. Monsanto had no experience in selling process control instrumentation, so it marketed those instruments through a subsidiary, Fisher Controls Company, that had marketing and distribution in place. As the next generation of instrumentation was being conceived, the Fisher team assigned to develop the instrument line started by asking Fisher representatives across North America and Europe to pull together groups of six to eight of their most innovative customers for group discussions. Several members of Fisher's development team then traveled to each office, sat down with the local group and presented their ideas for process control instrumentation.

Armed with the customers' reactions, they returned to their home office and relayed what they had learned to the system developers. When the development engineers had incorporated these conceptions into the proposed design, they went back to the customer groups. More reactions; back to the engineers: "Here's what they said they want to buy." The engineers designed some prototypes and back they went to the customers. (During this period, Fisher's team was also able to match certain instrumentation design issues with specific areas of expertise of certain customers.)

On subsequent iterations with customers, they carried not only the specifications and equipment prototypes, but also preliminary price estimates for the products. This sharpened the customers' focus; "For x amount less, we'll do without that feature," or "This feature is really important and I will pay for it." After each round of interviews, the specifications team would rewrite the specs; engineering would redesign; and they would recheck performance specifications and prices with the customers.

The control room instruments were thus designed by successive iterations of customer feedback. They were introduced to a high level of acceptance and, today, are doing very well. "The key was getting to customers very early," the development manager reports. "They got what they wanted; we let them help design it."

An executive of Dorr-Oliver emphasizes the importance of identifying the innovators among customers, and focusing attention on them in developing new products. He says: "Only 15 to 20 percent of customers will consider a new product. Therefore, it is wasteful to spend time with the others." Most customers, in his experience, will wait until the product is accepted before they buy it. Their opinion of an innovation is likely to be negative, even if the idea is sound. Worse, they may drag their feet and waste time in order to avoid committing themselves. Since Dorr-Oliver has a new-product-development organization, with its own sales force and marketing staff, this executive has had good success at training his salesmen to identify the innovative 15 to 20 percent.

Customers' Customers

Several companies carry close relations with the customer a step farther, by calling on the customer's customer. Marketdevelopment people of one polymer producer call on the end users of products made with their plastic—not just the molders who buy from them. They ask: (1) How they use the products, (2) why they use them, and (3) what are their latest products and ideas for products that might use plastics. A specialty paper manufacturer does the same thing, asking customers of the converters to whom it sells, "Why do you need this new liner?"

A planning executive at Analog Devices would like to see still more attention paid to the ultimate customer. He encourages his people to interview customers' customers—and also to talk to the customers' marketing departments as well as to their engineers. He says: "The marketing people look farther ahead. They can tell us today what their engineers will be wanting from us a year from now."

Ideas from Commercial Development

Many companies have created special units to find, evaluate and develop new product ideas (see page 47). Some are under marketing; some, under technical; others are indepen-

dent of either function. What they have in common is the goal of blending technical knowledge and market knowledge to make a successful commercial product. They visit customers—sometimes accompanied by the sales rep, sometimes not. Since their job is more technical than the sales reps', they call on the customers' technicians and engineers rather than the purchasing agents.

An executive sums up the reasons for such calls: "There's no point in buying the purchasing agent cigars if the product is failing. You must go to the user and find out why it is failing. Is it solving a problem for the user? Better than other products? That is what a *market* is: solving somebody's problems better than anybody else can."

The leading edge of Dow Chemical's well-orchestrated move into electronics markets consists of a Business Development Manager for Electronics and two Electronics Industry Development Managers. One reports:

"Spending much of our time with original equipment manufacturers and their suppliers, we identify and cultivate the chief specifiers and key development people, determine current needs and opportunities, identify long-term trends, and relay and pursue these internally." They also help screen and give priorities to identified needs, so they will fit Dow's strengths and available resources.

The Director of Marketing—Product Development at Enzyme Bio-Systems Ltd., a subsidiary of CPC International Inc., often starts with a tip from the parent company or a sales agent, then goes into the market and interviews customers and potential customers. His objective is to develop a "wish list"—"It would be great if we had an enzyme that would do so-and-so."

A new department at Bethlehem Steel Corporation has, as one of many responsibilities, the charge of ensuring that research programs are based on a sound market orientation. Product Applications, a group with metallurgical and engineering backgrounds, includes personnel with research, marketing, production and sales experience. Beyond the specific research direction function, and prerequisite to the marketing input, Product Applications people routinely contact customers at a level beyond the purchasing agent—specifiers, designers, long-range planners, engineers—to ascertain present and future customer needs. This information, evaluated in terms of overall corporate goals, provides the guidance needed to influence research programs toward those projects of greatest value to Bethlehem and its customers.

Technicians to the Field

One simple and seemingly logical way to make sure the research scientist understands what customers want before starting to work is to get the scientist and the customer together. The companies that do this tend to be enthusiastic about the results. "Marketing people should be in position to define needs and make initial contacts," one chemical company executive says, "but the technical person does the real selling when he explains the new dye—why it's safe, why it's effective—to the technical person in the customer company. And, maybe more important, that's the only way the scientists can keep up with what the customers want."

Another notes that it is a mistake to think that R&D scientists are "too unworldly" to talk directly with customers, and a worse mistake to assume that the scientists can learn all they need to know about the customers by talking with the marketing department.

Designing new products to customer specifications is typical in the paper companies studied. One of them characterizes its new-product-development effort as a two-step process: (1) Identifying the leading accounts in target markets, and (2) finding out exactly what they need. "We look for leaders in their fields, who make good profit margins and expect their suppliers to be just as strong in profit performance," says the Director of Product Development.

He has a 30-person technical staff. Once the staff has picked an account, some members go out and talk to the account in depth. "It's important to know all about the individual customer," he says. "We strive for a relationship such that if the customer hears about a new specialty paper development from any source, it wants to check it out right away with the contact at our company."

Members of Product Development's technical staff also try to be on hand for major trial runs at major accounts. "It is much better than talking over the telephone: You can see the problems—too much friction heats the machine at high speed; the coating is too sticky for the customer's hole puncher— and you can design corrections."

Both Dow and Eastman Chemical supplement the calls of their market development people with meetings between their technical staff and customers. Dow prefers to start by calling together the customer's top-level technical people for meetings with its own, usually at Dow's headquarters in Midland. "By giving them a presentation covering Dow's electronics-related products and technologies, we normally hit on at least half a dozen projects of potential mutual interest," an executive reports.

Eastman's new product managers generate ideas through seminars, held at customers' plants, where technical people from Eastman describe new advances that may have application to the customer. New products and market management set up the seminars, arrange their programs. Eastman technical service and R&D people interact with customers' technical people. The give-and-take often brings out needs that are within Eastman's capabilities to fulfill. The seminars are especially useful in product lines with a high technical content—like polymers.

At a chemical company, the Director of New Products makes a point of taking the R&D scientists out of the laboratory and sending them to call on customers "as soon as they have something to show." (He selects two or three leading customers for this.) At first, many of the scientists felt uncomfortable on these calls; but once the newness wore off, nearly all enjoyed seeing the practical side of their work. It

helped the scientists immediately by exposing them to first-hand evaluations and suggestions from the customers. Later on, it became a motivating force, as they looked forward to showing off their work.

At Grumman Corp., design engineers go out to meet aircraft carriers at the dock when the carriers return from duty at sea. In this way the engineers can get firsthand reports on how their equipment is working.

One diversified company's chemical division has turned to this direct approach out of necessity. There is not enough staff to have a separate commercial development unit, so the function has become "an add-on" for everybody. The Managing Director—Research describes how it works.

A customer, perhaps for polypropylene, will suggest to one of the salespeople: "Let's get our technical people together." The customers know what they want. Rather than try to select from a menu of products, they prefer to define the finished product in terms of its characteristics and ask the R&D people to tailor a resin to do the job. So R&D men go to the field, meet their counterparts in the customers' labs, exchange ideas, visit back and forth. Once the R&D man has started working, he just informally attaches himself to his company's polypropylene business unit.

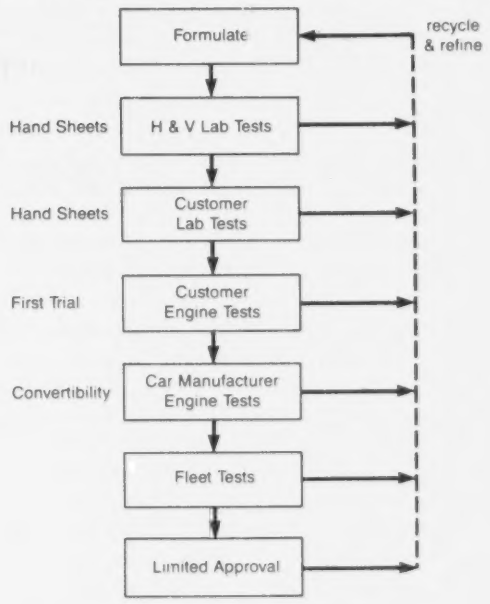
At Hollingsworth & Vose, an industrial-specialty paper company based just south of Boston, each R&D person must get to know certain customers very well. He calls on their technical people, knows their operations, and knows papermaking—especially in the area of his particular expertise. Often he can anticipate the customer's needs and suggest improvements. Sometimes the customer asks for something and, working closely with the customer, H&V's research labs develop it.

This close relationship continues throughout the development process. For example, the customer gives H&V specifications for a filter. "We need a paper that does the following . . ." Based on the target specifications, the R&D person makes hand sheets, tests them, and sends the best ones to the customer. The customer reacts and they go around again with hand sheets. The customer runs the material through its converting equipment, makes some filters, and tests them in its own lab. Then it orders a bigger roll, modified by the test results; and, finally, it places the large orders that follow successful development of the filter paper.

The product approval and qualification process for a gasket can take as long as four years, from inception to commercialization. Formulation starts with customer specifications and H&V's knowledge, and testing and refining continue through many feedback loops "until it is right."(See Exhibit 1.) An executive points out: "Since the gasket costs $5 and the engine $400, you can see why they test the gaskets so exhaustively."

Exhibit 1

Designing a Gasket at Hollingsworth & Vose



University Research

Many of the companies cooperating in the study maintain close relations with universities, some informally—with a view to exchanging ideas with other workers at the leading edge of technology; others more formally—supporting university research programs that bear on the company's new product (and other) interests.

A leading foods company benefits from both kinds of university relations. A seminar committee brings academics to the company on a monthly basis, and there are unscheduled visits both ways. Company and university researchers exchange ideas on both a friendly and a contract basis. Ownership of the industrial property rights that issue from sponsored research is negotiable, but "we usually reach a satisfactory agreement." The company often will contract with a university to do research when it is exploring a business for the future and does not have the technology in-house. Rather than hire the expertise—and possibly be left with unnecessary staff if it finally rejects the idea—it contracts for academic talent to do the research.

Another company does almost all its "pure" research (as opposed to product modifications) through universities. An executive points out that academic research can be superior to that performed in corporate laboratories: "Students bring to a project an attitude of 'why not?' while in-house research sometimes starts from 'We tried that'." This process is also a chance to evaluate the Ph.D. candidates who do the work as possible future employees.

Monsanto does a lot of research jointly with universities, because "that's where the leading edge of biotech is," an executive reports. Having worked with Harvard and Oxford Universities, it has now learned the principles of "propin-

quity" and "mass" and has settled on Washington University Medical School in St. Louis: It is important to have the research close enough for easy communication, and better to have many researchers working together than only one or two. Now Monsanto scientists work in the Washington University labs; Washington University scientists work at Monsanto's; and they have learned much from each other.

Monsanto makes grants to the Medical School; Washington University gets the patents, but Monsanto gets an exclusive license ("first access") subject to "walk in" by Washington University if Monsanto does not commercialize the patent. This suits Monsanto; if it cannot commercialize it, it does not want it.

Bethlehem Steel also uses university research, either on a direct contract basis or through nominal grants-in-aid and participation of personnel. It has both metallurgical and engineering contacts currently at many academic institutions. At Carnegie-Mellon University and Colorado School of Mines, Bethlehem participates in steel-research centers. Each has an advisory board composed of professors, graduate students, and representatives of participating companies including Bethlehem. The faculty suggests research; the board acts as a review panel; Bethlehem funds the work on a year-to-year basis.

Many of the companies consulted for this report sponsor small academic research projects at local universities. Out of a $50,000 budget, the Commercial Development Unit of Caschem, Inc. (Bayonne, New Jersey) not only pays its own expenses but also sponsors some process work at a local university. And several companies around Cleveland jointly support research on coatings and adhesives carried on at Case-Western Reserve University. A Case professor and his graduate students do the research; the consortium of companies that support it has first refusal rights to the fruits. The industrial property is owned by the consortium. Members have the right to use it; if it is licensed beyond the group, the royalties are shared by the consortium and the University.

Market Research and Suggestions From Consultants

Commissioned market research — concept testing and the like — of course plays a role in the generation of new product ideas, especially for consumer product firms. So do consultants who are called upon to suggest possibilities for management to investigate. (Anther role for consultants is to help company executives become more imaginative or creative in proposing such possibilities; see page 28.)

At Wagner Spray-Tech, consultants, including industrial designers and advertising agencies, sit in on brainstorming sessions held at the beginning of the five-year planning cycle. "They are more objective," an executive says. "They are a step back from the P&L, without blinders or built-in biases; and they are not afraid to challenge our management if they think it's justified."

Wagner credits these outside sources with its decision to expand its business into hand tools. And an executive reports that the idea for Wagner's franchised painting contractor business, Wagner Professional Inc., was hatched by a Wagner marketing man and some advertising agency people "having a few beers one evening in Phoenix."

A consultant's work can bear unexpected, serendipitous fruit. Not long ago a consumer products company hired a consultant to make some recommendations for new businesses, with reasons why the company should get into them. All but one of the recommendations were rejected after some discussion; but the remaining idea was intriguing, so a task force was set up to study it further. Additional market research revealed weaknesses in the proposal, and it was dropped after thorough examination. Shortly afterwards, an unexpected acquisition possibility presented itself. It would probably have been rejected out of hand, but earlier work on the task force convinced an executive that there was a "fit," and events have proven him right.

Other Outside Sources

Many new product executives draw ideas from outside the company by reading, talking to people, and generally keeping their eyes and ears open. Dearborn Division of W.R. Grace & Co. finds a productive source of ideas in continuously scanning the literature on new substances produced outside the company. Whenever a new substance is announced in the trade journals or manufacturers' literature, its possible usefulness in the water-treatment business is considered. If the Dearborn people think it might be useful, they buy some from the manufacturer and test it.

This is the way Dearborn developed its "Steamate" return-line treatments. It had perceived a need in the market for a chemical that would do a better job of protecting return lines against corrosion. Another manufacturer announced a new product for an entirely different use. Dearborn read about it, bought some, tested its application characteristics, and found that, with formulation, it worked in return lines. So the division patented it for that specific application and now sells it as well as licenses it to other companies as a return-line treatment.

At Caschem, the Commercial Development Vice President has arranged for all "off-the-wall" questions that come into the company to be funneled to him. Sometimes this provides leads. Someone will call in with a question that reflects a market need, and if it sparks the Vice President's interest, he will "hop on a plane and go out and talk."

The Commercial Development Department of a major pharmaceutical company's chemical division is looking outside the company for opportunities in biotechnology. Capitalizing on its strength in scale-up of fermentation technology and also in food chemical marketing, it initially made a direct approach to leading biotech firms. The biotech firms would provide products ready for scale-up; the pharmaceutical company would provide its manufacturing facilities, marketing knowledge, experience in obtaining regulatory approvals—in exchange for a share of the profits.

The company looked over the biotech field, evaluated the participants, checked how they would fit with its chemical business. It selected a short list of biotech firms and approached them with the proposition. The effort was only marginally successful. So in mid-1985 the company switched to a broader "shotgun approach." It issued a press release explaining its interest and calling for biotech firms to "bring us your ideas that are ready for commercialization." Many responses have come from unexpected companies with unexpected and novel ideas, and the Commercial Development Director feels that the biotech ventures development program is on track.

Generating Ideas Internally

In some companies, the search for new product or ideas starts in the research laboratory. For pharmaceutical houses, for instance, it is unnecessary to ask customers what they need because their needs are already well known; a cancer cure or a better way to regulate blood pressure will surely find a market provided they can be discovered, produced and approved by the FDA. Beyond that are internally generated ideas that lead to well received products for which no prior need has surfaced. Personal computers are a striking example.

A research executive of one drug company explains that each year the president of R&D allocates research time among the many projects in the earliest stages. Some of these are new substances developed in the lab; others are those identified from others' work or from literature search; others from computer-aided molecular design. The idea is to produce leads, which are followed up if they show promise, and eventually may be considered for development jointly with marketing.

Before an idea gets to the point where it is considered by marketing, a great deal of research has already been done. Out of every 3,000 to 10,000 new chemical entities considered in research, only 20 get to the development stage. The screening in the research phase has practically nothing to do with marketing. It is just scientific common sense: Some entities are "inactive"—they don't do anything—and some show little chance of being approved because of safety.

Another pharmaceutical company has developed a somewhat earlier and closer relationship between research and marketing. The two are brought together formally to talk about a compound eight to ten years before it can be commercialized. Informally, people from marketing and from the research laboratories mingle. But the initiative in developing a new substance still rests with the R&D people.

When R&D identifies a compound that may have significance, it writes a brief "product profile" and sends it to marketing, with the question: "Does it have commercial potential?" Then the screening and evaluation process begins. For every product profile written, however, many substances are tried and tested by research and shelved. The physicians and biologists in research do not have to be told what to look for in their fields of specialty; marketing input is required only after it appears that they may have come up with something.

In its niche, professional quality electrical tools, Amstar's Milwaukee Electric Tool Division shares with the drug companies the perception that any time it makes an improved product it will be able to sell it. Milwaukee systematically redesigns its core products—about seven of them—one after the other (with some project overlap), trying to reduce cost while retaining or enhancing quality. It goes through all parts of the tool from an engineering standpoint, makes mockups, then runs off 100 tools that are passed through distributors to large end users for evaluation. On the basis of this market feedback, it redesigns the tool and repeats the process. From start to finish, the redesign takes about two years.

Employee Suggestion Programs

Programs for eliciting suggestions from employees outside normal reporting channels were not reported often. This probably should not be interpreted as meaning that such programs are rare. More likely they are not so productive as to be considered very important as a source. Bethlehem Steel is developing a reward system for new product ideas. As planned, it will have three tiers: nominal recognition for presenting a suggestion; a more substantial award for suggestions that justify detailed review and action; and a major award for a successfully marketed new product. Dorr-Oliver has an "idea program"that started from a suggestion program aimed at developing new patents, but has been expanded to include ideas to improve efficiency and productivity.

The industrial chemical area of Monsanto Chemical Company has a similar process. Anybody can submit an idea to an Idea Selection Committee (most ideas come from R&D, but 25 percent are from sales, marketing or manufacturing). There is no standard form for submission; paperwork is minimal. "You can write it on the back of an envelope," says a Business Development Director. (Further details are found on page 33.)

Brainstorming

Several companies make use of scheduled meetings devoted to generating new product ideas. Some use special techniques to enhance the creativity of participants or special procedures for idea development. Mobay Corporation, a subsidiary of Bayer AG, Leverkusen, West Germany, uses the Delphi method for generating and classifying new product ideas (see box on page 28). A building materials company simply asks each of its divisions to come up with ideas for "five products you can't make, but would like to." The division is not expected to develop the new products; the promising ones are turned over to a university with a leadership position in the required technology. But the ideas come from the division.

The Delphi Method

The Delphi method draws upon the judgment of a panel of experts to obtain a group estimate in gauging the future. Salient characteristics of this method are:

- ***Anonymity.*** Responses are not associated with members of the group, so as to reduce the effects of dominant individuals and peer pressure.
- ***Interaction with controlled feedback.*** The inquiry is conducted in several stages; at the beginning of each stage, summarized results of the previous ones are fed back to the members, who are then asked to reassess their answers in light of what the entire group thought in the previous round.
- ***Statistical group responses.*** No consensus is sought; rather, the group opinion is taken to be the mean of the final opinions of individual members.

Source: David L. Harwood, Elliott S. Grossman and Earl L. Bailey, *Sales Forecasting*. The Conference Board, Report 730, 1978, pp. 12, 13.

Task Forces

Though task forces are employed far more frequently in coordination of new product development (see pp. 40), several companies have made use of them to seek out new products or new businesses. Olin Corp., after deciding in 1982 to diversify into faster-growing businesses (see page 5), used task forces as "reconnaissance patrols" to explore selected "thrust areas" and identify particularly promising directions. With a mandate to "figure out what we don't know," the Electronics Materials and Services Task Force worked for a year, developing a broad information base and educating managers and executives (including the CEO). It hired no consultants, because it wanted the experience of thorough learning that comes with taking no short cuts. The experience subsequently paid off in early recognition of new product areas and acquisition opportunities.

A large electrical manufacturing company habitually uses part-time task forces to look into new areas. The task forces combine technical and marketing people, all pulled out of line operations to avoid the staff imprimatur. "Anything that comes out of staff is suspect," a corporate executive explains. "Headquarters only acts as a catalyst."

The search for new products that are removed some distance from core markets is carried out almost entirely by limited-duration task forces. At one point, a group of people knowledgeable in integrated circuit technology was told to come up with recommendations for new products in 30 days. Then the group members got together with division line managers and marketing executives to find fits with existing technology, product range, market and industrial capability.

In 1983, a task force was asked to look at new consumer product areas. It examined many, sorted out its findings, built a prototype, and took it to the field. This exposure to customers convinced the task force that its original idea would not work, but it suggested others. The second product to reach the prototype stage worked.

Another approach, that of Signode Corp., is described in the case brief on page 41.

Campbell Soup holds weekly product idea sessions, where anybody's new thoughts are welcomed and thrown open to discussion by everybody present. Sometimes it uses the brainstorming process devised by a consulting firm: several people from Campbell have undergone formal training in the technique and function as session leaders. "We regularly hold out-of-office idea sessions—sometimes at the drop of a hat—to gin up thoughts for product strategies, new media uses, promotional ideas, and so forth," an executive reports. "At those meetings we encourage speculative thinking. We're not looking for engineering blueprints—but a big idea. In the idea-generation phase, we treat each idea like a newborn baby—with TLC—not discipline or testing."

At one point he adds, "we hired a cultural anthropologist who gave us some fascinating insights on the cultural aspects of soup consumption—and generated several new product ideas."

Another devotee of this brainstorming method is the Director of Business Development of a chemical company, at which a "New Directions" group meets periodically. "Most of what we discuss is worthless in itself; the value is that we're practising in a nonpunitive environment. We always talk about what something *does,* not what it *is,* using verbs, not nouns. For example, if you want to design a new way to remove trash from the office, you're lost if you refer to a wastebasket. What you analyze is the function, not the thing. Ask what is important, what is trivial; what is wanted, and what's not wanted."

Signode prepares its venture teams for creative new business development by bringing in consultants who are experts in the process of innovation. The idea is to teach group-dynamics skills: how to deal with factions, how to resolve clashes, how to prevent negativism.

Chapter 5
Evaluating and Screening Ideas—and Beyond

New product developers spin their share of horror stories. Here are three:

- Researchers of Company A found a way to use needle punch technology, developed in making carpet undercushions, in machinery for manufacturing outdoor carpets. Confident that they had a winner, they did the development work, design, styling, and completed the engineering for a production plant. The board of directors approved the capital expenditure; purchasing was ready to order a $2-million plant. At this point, the chairman took a trip to the site, talked with everyone concerned, and concluded that the marketing people did not have enough confidence in the product to continue. So he put it on hold, and it was never revived.
- The legal department of Company B fought an expensive patent battle over the rights to a new technological development before learning that the total market for the new product was $4 million—while the company's breakeven point was $10 million.
- Engineers of Company C found that a foreign competitor was developing a very large machine. On the basis of intuition and desire, but no investment analysis, the company's research committee decided to develop an even larger and better one. The engineers went to work on it, and the sales manager went out to test the market. There was no communication between engineering and sales for three months. Then, at a meeting of the research committee, the sales manager stood up and reported that he did not think the machine would sell. The project was scrapped.

These stories illustrate one of the central problems of new product development: How to screen out ideas that will not work before spending a great deal of time and money on them. If the mesh in the screen is too coarse, stories like these can be the result. If the mesh is too fine, though, the result is no new products.

Although systems differ, the objectives are the same: to winnow down the number of ideas, gradually and sensibly, so that resources go to the best of them. Most companies have no trouble generating ideas for products. The trouble comes in making wise choices.

The most common system for evaluating and screening new product ideas that was found among the companies cooperating in this study could be described as "continuous informal communication, tempered with management judgment." Much of the communication takes place within the company, but a good deal of it is with the market—preferably with the product in hand. To supplement this communication and judgment, several companies have adopted formal systems for screening and evaluating new product ideas.

In the early stages, an invention requires little time and money. But as it begins to be developed, the costs in both time and money begin to rise fast. A handful of people are sufficient for the laboratory research, but the closer the development gets to commercialization the larger the number of people involved. Early lab work costs relatively little, but costs go up as development gets closer to market: Tooling must be designed; production processes must be laid out; sometimes a pilot plant must be built; and, finally, a production plant if the new product is to be commercialized. Workers must be trained; sales forces must be acquainted with the product and supported with literature and marketing programs. The distribution system may well have to be modified, if not created from scratch; warehouses and dealers must be stocked; often product installation and service capabilities must be created.

As the development process approaches the crescendo of commercialization, the rate at which money is being spent accelerates; and so does the risk. In other words, it is important to find out early if the idea will not fly. That is the reason for evaluation and screening systems.

Screening Criteria

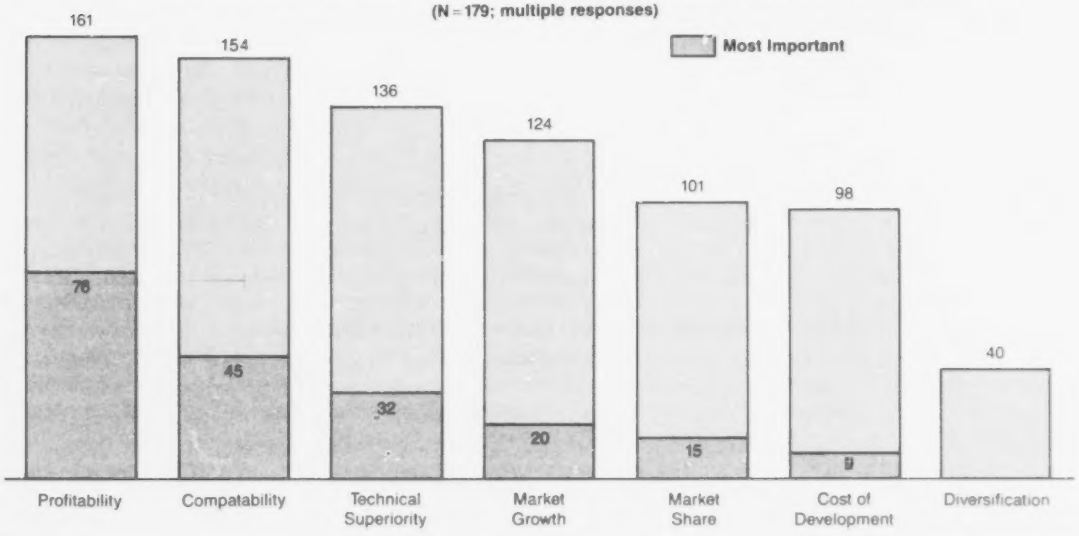
Executives cooperating in the study use many criteria in their evaluation of new product ideas. The most important by far is profitability, but that is not the only consideration. The questionnaire asked the respondents to check the criteria used, and to indicate the most important. (See Chart 6.)

Profitability is defined by many kinds of numerical measurements, executives report. Most common is return on investment, although some prefer to calculate payback period,

Chart 6

Criteria Used in Evaluating Ideas for New Products and Business Ventures

(N = 179; multiple responses)



return on assets employed, or a variation of these. Since the measurement depends on a forecast, it is far from precise at best. This fact helps to account for the widespread use of "qualitative" as well as "quantitative" criteria. Among the most important are compatibility of the new product with existing lines (for ease of marketing) and the value of the technological edge that a development is expected to confer on the company.

To aid in screening, a few companies have developed evaluation forms. The most comprehensive of these is a five-page Project Evaluation Request Form developed by Bird Machine. Whenever anyone—usually a product manager—has an idea for a new product, that person first fills out and submits this form to the Vice President and Technical Director, with a memo explaining the gist of the idea.

The first screen is shown in Exhibit 2. It is designed to separate true product developments from improvements, so that the development machinery will not be clogged with ideas that could better be handled routinely in the engineering department. Because of these definitions, the Technical Director does not expect to see more than five development ideas a year.

Upon receipt of the Project Evaluation Request Form and the summary memo, the Technical Director decides whether it is a new product development or just an improvement, according to the definitions. If it is an improvement, it goes to engineering; from then on the R&D department just keeps up with progress, but plays no further role. If it qualifies as a new product, he talks with the product manager, other R&D people, sometimes with the president, sometimes with consultants from universities with which Bird maintains close ties. If the idea stands up to this scrutiny, then the investment analysis begins.

The five-page form is exhaustive enough to assure that the "champion" has paid attention to many details. Before development begins, it must be signed off by seven people besides the product manager who initiates it.

- A Marketing Evaluation Schedule, including estimates of market size, competitors, prices, market share, and five years of estimated bookings and shipments, must be signed by the Senior Vice President Marketing.
- An Economic Evaluation, including estimated investment requirements, five-year effects on sales and profits, cash flow, and return on investment, must be signed by the Controller and the Vice President Administration.
- Project Specifications names the "champion." (A critical step, an executive points out, the omission of which "can have serious consequences.") It also spells out performance minima, and is signed by the product manager, the Vice President & Technical director, the Sales Manager, and the Vice President Engineering.
- A summary describing the project and giving it a timetable, with a detailed breakdown of costs over the next three years, signed by the Vice President and Technical Director and the President.

When all of these officers have signed the form, the project is effectively approved all the way to commercialization. It goes on the R&D schedule; a budget is authorized through prototype testing—including field testing. Reviews are scheduled monthly with marketing representatives. If viability is maintained, it is on to the marketplace. The screening process is designed to be so thorough that nothing further is needed.

Bethlehem Steel's new Product Applications Department has developed and is refining a form for "semi-quantitative"

Exhibit 2: How Bird Inc. Differentiates Between Product Development and Improvement

R&D Product Development

- New models with new functional capability, not new sizes.
- Incorporation of significant new technology.
- Major redesign for increased performance.
- Projects such as wear resistance, windage and friction studies, where research is required beyond vendor evaluations.
- Design and testing of mechanical, hydraulic, and electrical devices employing a new or unusual principle of operation.
- Development of new algorithms and systems specifically for our products.

Product Engineering Improvement and Maintenance

- Warranty correction work.
- Quality improvement.
- Adaptation of product lines to new processes or markets.
- Correction of field problems.
- Standardization.
- Metrication.
- Redesign of licensed products for Bird manufacture.
- New sizes related to capacity.

screening of both new ideas and existing projects. Quantitative evaluation of a broad spectrum of activities is hard to do, it is said, because early stage numbers are too soft for valid projections. Bethlehem's system is designed for an annual reevaluation of all activities, however: As a project evolves, projections become more realistic and the numbers harden in advance of major expenditures of capital.

The form Bethlehem will use is still under development, but it asks five basic questions: (1) What is the promise of success? (2) What will be the time to completion, from current date forward? (3) What will be the total remaining cost to full commercialization? (4) What does the market need, and to what extent has this need been identified and quantified? (5) What is the potential market gain, as measured by additional incremental business?

From the answers to these five questions, a rating is derived that helps assign preference to new product ideas. As a result, not only are approvals less subjective than in the past, but completion of the form mandates that basic market and cost input are developed for all suggestions. Bethlehem feels that this approach will help it get more benefit from the product development dollar.

Informal Approaches

In many companies, evaluation and screening is a continuous process from the idea's inception. In firms where most of the ideas spring from direct contact between company and customers' technicians, the screening starts as soon as the conversations start. No formal screening procedure is necessary. Pennzoil Products' Development staff screens as it looks for ideas. (See Exhibit 5 on page 57.) The system is not formal, but guidelines are used. Basically, it involves a lot of talking to people, inside and outside the company. As long as the idea makes sense and fits, Pennzoil proceeds to the next stage.

A chemical company's Director of Business Development describes his company's screening process as "just constant multidisciplinary worrying a bone." There is no set procedure, no checklist for screening ideas. He says: "Procedure is no substitute for good judgment. A checklist is only helpful if you don't know what you're doing. Besides, how can you have a checklist for solving a brand new problem?"

In this company, Business Development investigates the possible synergies that emerge from the technological advances reported by research and the customer needs unearthed by sales. If there is a need that it can meet and beat the competition, the company appoints a development-team leader who continues exploring—drawing help and advice from wherever he needs it. Sometimes he finds that the idea does not work, and it is shelved. When further exploration shows the idea to be promising, the development team becomes a business unit and is transferred out of Business Development to stand on its own.

Caschem's commercial development officer talks constantly with marketing, sometimes helping in the lab as part of a continual evaluation of new ideas. He keeps a close relationship with a local university professor, who helps as needed on a consulting basis. They screen as they go, with no formal process.

In its venture into electronics, Dow Chemical uses its development managers "like Indian scouts in uncharted territory." They gather ideas and screen projects continuously with people from customer and potential customer companies. They also use consultants to help evaluate projects, particularly in areas where Dow has some technical strength but little market know-how. They use multi-client studies, market research on specific topics, and private consultations.

Lack of formality does not equate to lack of hard work or lack of zeal. At a metals company, screening is particularly important because the business is so capital intensive.

The Case Against Screening

A few companies (all of them apparently successful developers of new products) seem to lean over backwards to avoid pushing development activity. The healthy climate for innovation at 3M Corp. has been described earlier. Management reasons that in such a climate, an idea that does not flourish by itself is probably not much of an idea. There are few formal screenings of new product ideas. Asked when 3M "pulls the plug" on a project, an executive replies: "When the champion gets tired. Of course," he adds, "our reactions to what he is doing may make him get tired more quickly, but the project will go at some level as long as he pushes it."

The other side of the coin is that if an idea has no champion,it dies. "Products are not developed by committees, but by individuals," the executive says. "If I have an idea, I talk it up to several people and try to drum up some enthusiasm. But if I see no fire in anyone's eyes, I drop it."

To some extent Analog Devices follows a similar procedure (see page 18). When a champion gets an idea, he must convince others to help him from its inception. If there is a task force, it is because the champion has talked some people into donating time and services to the project. If the division comes up with any money to help support the development, it is because the champion has convinced the general manager that the money will be well spent.

This approach to product development draws support from the good development records of both 3M and Analog. It also helps to explain some of the anomalies turned up in the study:

- The creditable record of successful product development at Bell & Howell, helped along by champions who persisted in developing products that they were told to drop;
- The record at one metals company, where technical people have "bootlegged" a sophisticated commercial development operation at a time of cutbacks and head count limitations through a combination of energy, psychology and creative financing.

The prevalent attitude among the people who cooperated in the study is that the product-development effort is helped most by generous budgets and a push from the top. But a minority takes a different view, that development is likely to be more efficient if the road is not made too easy for the champion doing the developing. One executive, who came up through research, sums up this view: "Show me a man who believes in devoting more funds to new product development," he says, " and I'll show you an R&D exective."

For every idea being considered seriously, a project manager coordinates the market and economic analysis that precedes an important investment; but screening is a less accurate description of the process than "achieving consensus."

The project manager and people from marketing and manufacturing talk back and forth, study and talk some more, until they understand each other and agree on the project. Manufacturing is brought in early, because it almost always "has to make it on the line we have." This preparatory work is so thorough that acceptance of the product by the organization is almost automatic.

Senior Executives as Traffic Controllers

In many of the companies in this study, the screening process comes down to reliance on the good judgment of a few executives. At Enzyme Bio-Systems, the president and the product development manager sit down together with the list of dozens of ideas that have issued from idea-generating sessions and the strategic-planning process, and they select two or three that they think are worth further study.

During its periods of greatest productivity, Phillips Petroleum's idea screening has been done by R&D executives on the basis of their own best judgment. R&D management recognized the importance of the accidental discovery of high-density polyethylene, and ran with it. And today, after a period of very little new product development—accompanied by greater reliance of financial analysis—Phillips has gone back to placing its reliance on the assessments of its R&D executives.

At Campbell Soup (among other companies), management encourages the divisions and business units to compete for development funds. On the basis of its own experience and judgment, Campbell's management team places investment behind the new products it considers the best. Says an executive: "We have new product ideas lined up like planes at an airport—ready to take off. Management becomes the traffic controller, basing its decisions on available investment dollars, competitive atmosphere, and a corporate strategic plan."

New Product Committes

Some companies employ new-product committees to evaluate and screen new products—and/or in later stages of development. A building materials firm has such committees at division level, where virtually all the research is done. The committees meet quarterly to give priorities to new product ideas, asking themselves what is feasible, given the talent available, and what is most likely to enhance market share or secure a niche in a new market. The committees are appointed on an annual basis, with about ten members representing sales, marketing, R&D, operations, and, sometimes, finance. The chairmanship rotates among functions, to keep a team orientation. Membership is changed often to elicit fresh ideas, and also to provide a management-training ground by exposing members to all functions. "The danger with a committee like this is that somebody will say 'We've tried that,' and an idea will be discarded without enough consideration. Technology changes, and markets change; what didn't work years ago may work today," an executive explains.

Monsanto's industrial chemicals area has multistage screening process involving an Idea Selection Committee—for the first stage of screening—and a Growth Committee—for the final stage. As noted on page 27, the ISC comprises people from R&D and Business Development and evaluates the large number of ideas that flow from all over the divi-

sion. The ISC appraises each idea against a list of criteria (see Exhibit 3). Based on the committee's judgment, the idea may be "pitched out," "recycled,"or elevated to "project team status. "

If the ISC thinks an idea has promise, it appoints a project team to look into it further. The project team might include Business Development people to identify customer needs and market potential, researchers to develop a product and test performance, and others to analyze competition, economics, and other issues. At this initial evaluation stage, the project team works part time, requiring no special budget. It is told to study the idea for some period of time and then recommend whether to scrap it, recycle it, or proceed further.

Many ideas are scrapped after the study by the project team. No stigma is attached; it is not the team's job to promote the idea, but to evaluate it, and no major money has been spent.

The Growth Committee, chaired by the managing director of the operating company, receives the ideas that have passed through the Idea Selection Committee, including the project team assessment. If the Growth Committee decides that an idea is worth pursuing, it allocates resources to push the project and provides funds to finance the effort. By the time the Growth Committee agrees to set up a new team, the project has passed preliminary assessments and its chances for success are considered to be worth the added funding to take the project to the next level of development.

At Eastman Chemicals Division, the Innovations Committee plays a similar role. Once a development team has determined that an idea looks promising, it devises a basic plan of attack and recommends that it be made a project. The team writes a proposal outlining the need, how much business is expected, what key people will be needed on the project team. This proposal is submitted to the Innovation Committee. This committee is chaired by the Director of Research & Development, with representatives of manufacturing, marketing, technical development, and R&D. A new product champion defends the proposal. If the committee agrees to fund the project, it gets an accounting code, a project leader is appointed, and the development is begun.

At Waters Chromatography Division of Millipore Corp., a New Product Committee monitors closely the product-development activities of the special project teams (business units). At the outset, the committee decides which ideas are candidates for further development. It may authorize a prototype for test marketing, then review results before making any further commitment. The number of proposals is thinned through continual reviews: The good ones are pushed ahead another step; those that do not prove out are dropped. "While rejecting or dropping projects is obviously disappointing to the champions, it has been our experience that this is far more acceptable than not having the opportunity to develop one at all," an executive reports.

At ICI Americas, when research abroad develops something that does not fit with a U.S. division of ICI, the small New Ventures group in Wilmington, Delaware, looks at it,

Exhibit 3

Monsanto's Preliminary Project Screen

Project: Date:
Market: By:

Market Need	Met	Partly Met	Unmet
Business Strategy	Cash	Maintenance	Growth
Proprietary	Weak	Moderate	Strong
Commercial Timing	Long	Moderate	Short
Profit Impact	Small	Moderate	Large
Environmental	Problems	Manageable	No Issues
Competition	Strong	Moderate	Weak
Market Growth	Low	Moderate	High
Capital Intensity	High	Moderate	Low
Skills Required	All New	Some New	Existing
Overall Ranking	Poor	Moderate	Excellent

analyzes markets, technology, cost/price relationships, competition, and makes a recommendation to management. If the product looks promising, New Ventures tries to get a U.S. division to take it on — or it is handled as a separate business (from a simple patent license up to a full-scale manufacturing operation).

Here is an example: New Science Group in the U.K. develops a specialty for the cosmetics industry. After talking with technicians in the lab and sales people in the field, the New Ventures manager recognizes an opportunity in the U.S. market, and his group studies the opportunity to find out how the ICI family can exploit it. Maybe the decision is to make the raw material in Pakistan and ship it to the United States for processing. The U.S. division listens, decides to fund the development, and carries it forward from there — reporting to management at specified checkpoints to justify additional expenditures. If the division is not interested, New Ventures may try to generate some sales on its own: "if we get sales, we'll be able to get the division interested. If not, in a year we'll close down and license."

One committee that was recently scrapped (in favor of a more formal system) was a steering committee, including the

president, the chief technical officer, and other corporate officers, which met monthly to listen to new product proposals. Results were poor, an executive of the company says, because the committee accepted too many projects, most of which were modifications that would have been better handled in the divisions. Committee members had no formal system of investment analysis—"just took on what appealed to them and what they thought they were good at"; and they lacked patience, never considering a project that went out as much as three years.

Sequential Screening Systems

As earlier pages of this chapter have suggested, new-product screening is not necessarily a one-shot phenomenon, entailing a single "go" or "no go" decision. Rather it often involves a series of such decisions. Pharmaceutical companies offered a striking illustration. For, as stated on page 27, out of the new substances considered in the early stages—those identified from literature search or computer-aided molecular design, as well as new concepts developed in the lab—fewer than one percent will be promising enough to merit development. The others are usually abandoned for obvious reasons—they do not work, for example, or they show little chance of meeting safety standards.

When the president of R&D at one such firm is convinced that a substance has a good chance of becoming a product, he proposes it for development. Marketing's contribution begins with the development phase. If the president of the appropriate business unit agrees with R&D, both of them sign the marketing plan, which carries the project into preclinical development. Further screening is continuous through the *in vitro* (test tube) and *in vivo* (laboratory animal) testing phases. ("Many a product dies with the mouse," an executive notes.) By the time clinical development (in humans) begins, of, say, 15 substances that have been proposed, eight have survived. After clinical development, the number has dwindled to about 1.2 submitted to the FDA for registration; and later, to only one finally approved.

A second pharmaceutical company follows a similar sequence in evaluating new products. The decision of whether to push a product and how hard to push it is really a long series of decisions stretching over years of development. Research and marketing are brought together early, at first formally and then in more structured ways. The sequence runs like this:

(1) When research identifies a compound that may have significance, if proposes a Product Profile (see page 27). Marketing evaluates the product against the perceived need and how it will evolve, other ways to fill the need, patentability, potential competition. Marketing people study literature, attend symposia, hire consultants, bring in the best thinking they can muster, and come up with a Statement of Interest, which assumes the steps to market a product and a forecast of "third year net additional sales"—net of lost sales in products presently sold. If the forecast is under $50 million, the response is usually "no interest"; and research almost always sets it on the shelf.

(2) If marketing's statement is positive, the dialogue continues. Research conducts more trials, learns more, and writes a more comprehensive Product Profile.

(3) When this reaches marketing, the new data are examined and a more formal Statement of Interest is written. Marketing also starts work on the Marketing Needs Report, which can run to 50 pages, detailing what needs to be done to market the products optimally.

By now the product has passed the main screen. Major problems in the laboratory or new developments in the market may derail it, but it has been judged worthy of the important resources to be spent in developing it.

At Wagner Spray Tech, new product ideas follow a carefully marked path from inception to commercialization. Screening starts very informally, and goes through successive steps designed to allow enough freedom for creativity to express itself, but to weed out the unfeasible ideas before much money has been spent.

R&D and Marketing are deliberately kept close, to promote "hallway collisions." If anyone has an idea, it is discussed informally with associates in both disciplines. If it survives informal conversation, it enters the more formal screening process.

Working together, a researcher and a marketing person prepare a broad Feasibility Request, which makes the idea a matter of record and encourages some action. It requires two signatures, those of the Vice President R&D and the Vice President Marketing. The requirement for two signatures forces R&D and Marketing to talk to each other early and makes them stay close.

The Feasibility Request is deliberately kept simple and is not very design restrictive: "We want a black box that will do such-and-such. It should cost no more than so much and weigh less than five pounds."

At the outset, seed money for 30 to 60 days is normally available in the regular budgets. The champion may "bootleg" preliminary design work; the marketing people may do some market research; informal conversations and meetings continue. The requests are reviewed quarterly by the two vice presidents, to decide if they are still worth pursuing and what to do next. Up to this point, not much money has been spent, but there has been much thinking and much exchanging of ideas between technicians and marketers.

The next step, when all consider it should be taken, is the Product Development Request, which requires three signatures, and provides for design funding, engineering man-hours, and money. The PDR is the occasion for a feasibility review, fairly formal but still dependent on many assumptions. This includes engineering specifications, an assessment of the competition, and a preliminary rough ROI calculation.

If all three Vice Presidents sign the PDR, a new-product-development team is formed, consisting of: project engineer, product-marketing manager, quality-assessment engineer, manufacturing engineer, and purchasing representative. The

team decides on its own schedule and its own methodology, continuing to work informally up to the time that tooling is needed. Before tooling can be funded, all vice presidents must sign the Tooling Release. Finally, when the product is ready to go, all must sign the Release for Production.

A Wagner executive points out that this step-by-step approach to development has the important benefit of providing ample opportunities for pulling out inexpensively fairly early. Even after the team has begun working, there is no stigma attached to quitting before the Tooling Release is signed. The moment of truth for a development is the Tooling Release. After that release is signed, there is no time for marketing to say: "It won't sell"; or for engineering to announce that the machine might run for 50 hours, but just will not make it for the specified 500.

Dorr-Oliver is another company that believes in spending money up front to screen out unworkable ideas early. It starts with an inexpensive evaluation by thirteen Idea Review Centers of ideas that come in from a companywide suggestion program. Ideas that pass the scrutiny of the centers are funneled to the Idea Evaluation Committee. This committee determines which ideas are worth pursuing, indicates its preferences among them, and may assign a project leader to be the best ones.

Armed with an initial research allocation, that individual writes a preliminary business plan and submits it to a Review Committee, which includes the Vice President Technology, responsible for running the whole new product development process. If that committee's reaction is favorable, it authorizes more funding and instructs the project leader to prepare a comprehensive business plan. (For more on this company's approach, see case brief on pages 48-49.)

Screening in the Market

To a large number of the executives cooperating in this study, the crucial step in evaluating a new product idea is to get a prototype out into the market as early as possible. This is not to say that they think internal systems of screening and evaluation are not valuable; it is just that they feel a good deal more comfortable with a development that has been shown to some customers and has elicited some feedback from them.

For some—like the paper companies, several specialty chemical companies, and the chemical company that made an acquisition in process control to market its process-control instrumentation (see page 23)—the market helps design the product through an interactive process. A few companies even do their development work in their customers' labs. A metals firm has some European technology for a thin-wall heat exchanger that it will send to a customer for evaluation; if it proves out, the metals firm will buy a big plant.

A manufacturer of printed-wiring-board-processing chemicals makes it a point to limit design to get to market faster. Rather than strive for perfection, it determines the minimum level of workability and temporarily freezes the design. Improvements will come later, and will be customer driven. Documented "customer-site" tests not only provide design input, but also cost data on which to base future pricing strategy. And the R&D executive of another company, urges making a "breadbox prototype" early, so that there will be something to work with. "Poke it and see if it moves," he suggests.

Meredith Corporation has a cheap and effective way to screen ideas for new publications: Its division on special interest publications has an ideal test-marketing laboratory. Every year it publishes *Christmas Ideas* and sells one million copies only at newsstands. Because *Christmas Ideas* sells so well, magazine distributors are willing to let the division place prototype issues of a proposed publication on the stands. For an "over-50" magazine, it included a questionnaire asking: "Would you subscribe?" That magazine was never launched.

Meredith has other approaches. *Country Home* got started when an editor put together a dummy on bootlegged time, convinced the group to print an issue, and it sold like hot cakes. *Wood* was almost forced on the company by two editors (and amateur woodworkers) whose last project at Meredith had just failed. "Between assignments," they made a dummy and did a test mailing ("Would you subscribe?"). It took off "like a rocket," now has 250,000 circulation. Meredith has sometimes been able to test the market for a new publication, and make money on the test.

One reason for getting a prototype into the market, a Meredith executive says, is to make sure the market research is accurate. Without something concrete to look at and feel, he cautions, "what the people say when they are interviewed will depend on the wording of the questions."

The Eastman Chemicals Division recently has instituted a "product-development-assurance phase" into its screening process for all but the simplest products, to get more customer feedback sooner. First thing after approval by the Innovations Committee, the product is produced in limited quantities and shown to a few key customers. Based on their reactions, Eastman's new-products people ask: "Can we make some logical changes?" and go back to see the customers again with the improved version. They find customers willing, if not eager, to get in on the ground floor of the development.

Since an executive says about one out of ten new products succeed, and three out of four of the successful ones are changed significantly during the development process, it makes sense to get it out to the customer—"the sooner the better." Only after this step does the project team go on to decide "how we're going to make it" and put together complete data. For the simpler product improvements, Eastman does much less assurance testing.

As soon as possible after the original market evaluation at a major chemical company, the project team or task force takes the idea outside to a few key customers. An executive asserts: "Timing is important. You can't wait too long to test, because you can waste time and money on internal misconceptions; but you must have a story that is well thought out,

and a fair number of the questions answered. And if patentable material is involved, patents should be filed before going to the public."

This executive believes that the second most important person in commercial development—right after the product champion—is the person in the customer firm who will work with and try the new product. "It has to be the right kind of person and the right kind of company," he says. As an example from experience, he cites the development of a new process for improving ammonia yields.

Although the technology was unproven, the product champion was convinced that it could add 3 to 5 percent to ammonia yield at an investment of $1 million—which for an average-sized ammonia plant would translate into less than a two-year payback. The product champion went around and talked to people in the market, but no one would take a chance on the new technology. Finally he identified two men, in different small amonia manufacturing companies, who were perfect for his purpose: "They were both mavericks, each with his heart and soul dedicated to making his plant the best it could be." They also had flexibility in what they could do in their plants. The project manager offered the two a special deal, permitting them to license the technology at a lower fee because they would be the first to use it. Both installed the technology, and their plants proved the worth of the process. Now it has been licensed to nine large ammonia plants.

Two Examples from Union Carbide

The value of screening ideas in the market is further illustrated in a pair of examples from Union Carbide Corp. Both deal with Carbide's entry into the computer software business. One was successful; the other was not.

Carbide had developed an in-house capability for making software to solve business and technology problems. Market studies convinced management that it could sell the software, and two products were identified to push.[1]

One was a plant computing software system, developed by Carbide for its own use. It was effective internally. Carbide had all the pieces in place. It did not even have to build a demonstrator: There was already one in the plant, which the sales reps described when they went out on calls. The salespeople found potential customers unimpressed. They could not relate to Carbide's successful use of the system. The sales force also discovered that in the customer companies many people had to sign off on the purchase authorization for this kind of software—including the head of the Management Information Systems department, who was often at odds with the engineering department.

The product did not sell. A Carbide executive reports that everyone finally knew it had failed when a sister division at Carbide bought a competitor's system—even though it cost more—because it was simpler. Specifically, the executive says, the product failed because: (1) Having been designed for Carbide, it had features that were not essential to clients; and it came up short on simplicity and compatibility. (2) It had to be approved by clients' MIS departments, which disliked it because it was "not invented here." (3) Technical support was not focused, but came from several parts of Carbide. (4) The market called the tune on the hardware. As the executive put it: "We had a good train, but it wouldn't run on the customer's track." Carbide finally gave up on the plant computing software and withdrew it from the market.

At about the same time, Carbide also introduced a process-engineering software package, now called "Advent," which builds on classical engineering technologies and cuts energy costs. Carbide decided to develop this system specifically for the market, rather than take it out of what it had developed for itself. It paid less attention to how inexpensive it was, and funded the development up front, pricing it at the value it perceived the customer would save in energy costs. Carbide had ample staff in place for technical support. It developed the package for the one kind of hardware most prevalent in the market. In this area, purchasing decisions were made by the enginering departments only.

The "Advent" package very quickly became a hit. Customers accepted it, and there have been many applications—all successful, with 30 percent to 60 percent energy savings on new applications and up to 50 percent savings on retrofit. Generally, customers get a one-year payback. The product is a success, and Carbide is shooting for $10 million a year in sales.

Their different experiences in developing these two pieces of software taught Carbide several lessons: (1) Internal products do not make a market. Find the market, and design the product to fit it. (2) Learn the clients' decision-making process early—it can be as important as the product itself. (3) Commit the resources needed to develop the product up front; do not try to go cheaply. (4) Have patience. (5) Understand the customers' needs and values.

[1] For other examples of commercializing resources or competence developed for internal use, see Brown, *Refocusing the Company's Business*, p.9.

Chapter 6

Coordinating Product Development

Generally, there is no clear dividing line between screening ideas and coordinating development of the products that grow from the ideas. Screening and evaluation require knowledge contributed by both technical people and marketing people; coordinating development requires more of the same, plus contributions from manufacturing, sales and, sometimes, other functions as well.

The basic step is getting people from the different disciplines to talk with each other. As simple as that seems, it can not always be taken for granted. An executive of a pharmaceuticals company started scheduling meetings bringing together product development engineers, sales people, marketing people, financial people. "The sales and marketing people mostly were acquainted—they worked in the same building—but the others frequently had to be introduced to each other." Thus Bell & Howell schedules day-long meetings "whenever the opportunity presents itself," bringing together engineers and marketing people with a view to making them more aware of each other, and in the hope that more informal contacts will follow.

A pharmaceuticals executive calls the improvement in communication between research and marketing "the most significant change" in his company over the last ten years. The company has been "technology driven," and prides itself justifiably on its research capability. Every six months research has an in-depth review of each product it is working on, chaired by the head of the laboratories, with key people reporting all aspects of the product's development on a tightly scheduled format. When this executive joined the company's marketing staff, he asked his opposite number in research if he could come to a product-review meeting. The response from the chairman was: "No. The meeting deals only with research and is of no concern to marketing."

As time passed, the executive and his opposite number in research got better acquainted, and he finally got permission to audit a product-review meeting. He kept his ears open and his mouth shut. Gradually, he was accepted; research began to ask him questions. Now he and others from marketing attend regularly, speaking as part of the schedule. Research has even rescheduled reviews to be sure marketing could be represented.

Informal contacts between marketing and research also have become important. The executive and his research counterpart see each other often, and they encourage opposite numbers at lower levels to do the same—"get on a first-name basis," and "have lunch together." They keep each other informed, find it easy to work as a team. The company uses a system of compensation that keeps them on the same level.

Westinghouse has found that its program of setting up independent ventures has promoted needed exchanges. (See pp. 10-11.) "Elegant schemes to get R&D to talk to marketing don't work," an executive states. He explains that in normal product development at Westinghouse, the necessary communication and iteration between corporate R&D and the business units take place—because the BU is buying and wants its money's worth.

"But the ventures iterate at least twice as much and twice as fast," he says. The reason is that in the business units, with many ongoing products, new product development is important, but keeping the P&L going is the order of the day. In the venture, the new product is the only thing; so the ventures benefit from their smaller size, greater motivation, and greater concentration.

Several companies achieve good rapport between technical and marketing staff by assigning individual researchers to work with specific product divisions or small business units, or by organizing their R&D departments to correspond to the product-marketing organization. At USG, for example, Central Research is divided into laboratories that correspond to product-division organization. Even though the labs are concentrated in a park that is at a considerable distance from the divisions, research technicians feel like members of the product-company team, and work closely with marketing and manufacturing. This works fine for coordinating product improvements and line extensions, less well for brand-new products.

Product development at Glidden's Industrial Coatings unit is coordinated through a matrix of technical managers and market managers. (See Exhibit 4, p. 38.) Not all the boxes in the matrix are active (marked with X's), because not all the technologies will be commercialized in all of Glidden's markets. Where a technology does have an application in

Case Brief

Glidden's Water-Reducible Liner

Until the early 1970's, beverage cans were lined with a solvent-based epoxy or vinyl coating. As concern grew over the release of solvents into the work environment or the atmosphere, Glidden became interested in a water-reducible coating.

In 1972, the Market Manager-Container Coatings and the Technical Manager-Container Coatings agreed that the development of a water-reducible coating for the interior of metal cans was promising. They also decided that a new polymer was required. Consequently, the Associate Director of Polymer and Coating Research became involved. The polymer chemists assigned to the project discussed the problems, drew up specifications for a polymer, and initiated synthesis of polymers—which were then formulated by coatings chemists into a coating and tested to determine if the polymers met the objectives of the project.

When the formulation was successful, Glidden's next step was application testing on equipment designed to simulate a customer's application process. The Glidden Research Center has installed several pieces of equipment that simulate customers' application methods. There, new products and technologies, as well as product modifications, are tested before shipment to a customers's plant. Trial runs are made at a customer's plant before commercialization; and if problems are discovered, additional laboratory work and testing may be necessary.

The water-reducible lining was commercialized in 1977, five years after the start of its development. By 1979, the lining had achieved good sales; by 1985, it attained a 70 percent share of the market. Glidden attributes its success to two factors and to a chain of strategic business moves. (1) The water-reducible liner offered the customer economic advantages, as well as an environment free of solvent emission. (2) After several modifications and trials, it worked better in the customers' plants than prior operations had.

Glidden's strategy gave the company leadership in the industry because from 1977 to 1980 there was no competition; Glidden's product was the only one commercialized. By 1980, others in the industry were going after a water-reducible liner, but Glidden's patent kept them at bay. Then in 1981, Glidden developed a coating of equal value at less cost to the customer and maintained its leadership position. A Glidden executive estimates that in two or three years the cost advantage may be almost gone, "but that makes a nice nine-year run," he says.

a market, the two managers are jointly responsible for development. In some cases, a technical manager may look after only one technology; in other cases, a technical manager is involved with a market and several technologies, for example, both water-reducible and conventional coatings for metal containers.

The technical managers report to corporate R&D. Each has his own budget and some laboratory facilities. The market managers are part of division staff, reporting to the Vice President-Industrial Coatings. For each active box of the matrix, the technical manager and the market manager—working closely together—frame product-development objectives that become part of a five-year business plan.

The two managers examine the following questions: What does the customer need? Where is the competition? What can we do to be the leader? Throughout the development project, their iteration and effort provide the drive toward commercialization.

How two levels of R&D work together in a specialty chemical company is illustrated by this example:

This company has 14 relatively free-standing profit centers, each with its own research. Corporate R&D has responsibility for research that crosses divisional boundaries or lies outside existing business areas. When one of the divisions comes up with a good idea that is beyond its capabilities, it presents it to corporate and asks for help.

Not long ago, one of the groups got an idea for reducing the costs of alkaline sizing. In the past, massive quantities of starch were used in applying the sizing, to keep its fragile molecule from breaking down. Group thought a polymer might replace the starch, did some testing within its capabilities, defined the opportunity, and asked corporate research to find a molecule with the desired characteristics.

The Corporate Vice President R&D liked the idea, so he advanced the polymer project on the priority list, shifting

Exhibit 4

Matrix of Glidden Markets and Technologies

Technical Managers \ Market Managers	Metal Food, Beer & Beverage Containers	Appliance	Wood	Coil	General Metals	Plastic
Water Reducible Technology	X	Electro-coat	X	X	Electro-coat	
High Solids Coatings		X			X	Gel-Kote™
Powder		X			X	
Conventional	X			X		

Case Brief

Streamlining for Survival at 'Basichem'

Up until the recession of 1981-1982, the "Basichem" Division of a large capital goods company was composed largely of manufacturers and marketers. The divisions had no capability for product development. R&D and engineering were centralized at corporate. Although the firm was a leader in the capital goods field, chemical capability was limited to process engineering.

As the capital goods recession intensified, the corporation decentralized R&D and engineering. A Managing Director—Research, Engineering and Business Planning was hired to run those functions for "Basichem." He took on chemists and engineers; but as business continued to worsen, he was forced to cut back 25 percent on staff. In the course of streamlining for survival, "Basichem" Division recognized dissimilarities among its own businesses and decentralized itself into profit centers, each with a general manager responsible for all operating functions.

There is no formal procedure for commercial development. There is not enough time, not enough staff. Rather than experiment in the lab to develop new substances, R&D people are encouraged to go out with the sales and marketing people to meet customers, who show the technicians what they want and ask them to tailor a substance to do the job. Out of necessity, the research chemist gets very close to the business unit that makes and sells it. Although he is an employee of the division research labs, he is encouraged to work as part of the business unit.

No requests through channels are required. The business unit's sales rep just calls and asks the researcher to come along to XYZ Plastics to talk about the such-and-such problem. The researcher goes, and charges his time to the business unit. This system sometimes means extensive travel for the R&D person. The R&D labs are in the northeast, one of the plants is in Texas, and the customers are spread throughout the United States. Largely because the R&D man feels like a member of the team, the system works smoothly.

When R&D developed in its northeastern laboratory a polymer to be produced in Texas, an R&D man and an engineer from division were assigned to a task force that flew to Texas and worked full time with the plant's staff until the process was scaled up and debugged, then stayed on to teach plant personnel how to work it. They were in Texas for three months, flying home some weekends. These activities enhance the spirit of teamwork.

This spirit is manifest in other ways. When there are operating problems, plant problems of short duration, quality or efficiency problems, the business units frequently ask for help. The R&D Director is always careful to respond by putting research and engineering people on a team led by the plant manager. "Together we're fixing it. I'm assigning members; you're assigning members; you're in charge. It's your plant, and it's your problem." And the R&D people are not pulled out as soon as a solution has been found. They stay at the plant until it has been implemented.

One example of "Basichem's" system in action involved a basic chemical plant whose output included an unusual by-product. Marketing people at the business-unit level found a way to sell the by-product. In 1982-1983 the plant's operating rate fell to 60 percent. Marketing learned that unfilled orders for the by-product were stacking up—even though it could not sell the principal product. The business unit's marketing man called a friend at R&D, which experimented and invented a way to make the by-product on purpose—using a different feedstock and different operating conditions, but requiring no change in the plant.

Once it could be done in the laboratory, a task force of R&D and engineering people went to the plant, where they worked jointly with plant staff under a leader appointed by the plant manager. The task force stayed at the plant, scaled up the process, modified it, developed the operating procedure. When it was running right, the task force disbanded and the R&D and engineering people went home. Now the plant schedules blocks of time operating normally, followed by blocks of time using the new process. The new product mix is more profitable than the old.

some people's assignments in the laboratory to accommodate the work. Corporate R&D and Group Marketing met frequently, with much by-play. The labs would develop six polymers, make small quantities of each, and send them to Group where they were tested. They honed down the process with successive meetings and trials, and decided on the best formulation, which Corporate made and Group field tested. The payoff is that replacing the starch with the polymer makes the sizing easier to apply, thereby saving money in the manufacturing process.

Another chemical company accomplishes the same end by encouraging its research specialists to consider themselves a part of the business unit that makes and sells the chemicals in their respective fields of specialization. This, too, works smoothly for product developments close to the existing lines, although it can mean extensive travel for R&D people. (See case brief above.)

For developments that are somewhat less close to existing lines of business, the consensus is that there are two ways to get all the functional groups to work together: (1) By organizing the developers into a task force or project team, permitting each to contribute expertise as needed; (2) By providing a strong, highly motivated "champion" who will pull all groups along toward the development goal in spite of themselves.[1]

[1] The work of product champions has been examined in the discussion of the climate for innovation and is further illustrated in the 3M case brief on page 5 and the case brief on page 40.

Case Brief

'Machineco's' Marketing Champion

"Machineco" is a middle-sized manufacturer of industrial tools and equipment. R&D is centralized at the corporate level; marketing is in the divisions; new product development is the responsibility of the division general managers.

A marketing champion supported by a flexible technical force is the key to "Machineco's" development effort. The champion—typically the leader of a small business unit from one of the divisions—enlists help from corporate R&D as needed, on a project basis; and coordinates R&D, division product engineering, the division or SBU marketing people, and the manufacturing people. Their activities wax and wane, but the champion holds it all together and drives for the commercial objective.

Needs and ideas come in from the market to the SBU's. With the help of division marketing, they are defined, the opportunities are reviewed, a business plan begins to take shape, and a "birth certificate" is written along the following lines: (1) What's the product? (2) What's the need? (3) How much sales can be expected over the next three years? (4) What price can we charge? (5) How much will it cost to make and sell? (6) Hence, what profits can we expect? At this point, if the division approves, the champion is given the go-ahead to carry the project through all the way to launch, subject to several reviews by division management.

Typically, the champion asks corporate for technical help. The appropriate person from R&D is assigned to work with a product-development engineer from the division. "It's an iterative process between the two," an executive explains, "with the R&D man doing most of the work at first, and the product development man doing more and more as they approach a new product." After a while (as the chart illustrates), the R&D man's contribution drops off—unless he is needed for trouble-shooting—and a manufacturing engineer from the division begins to play an increasing role, as the product-development engineer's role declines.

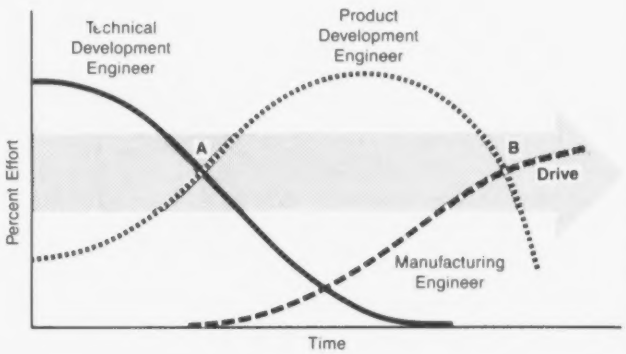
The product engineering group in the division works to design a functional product, to make it easily manufacturable, to hold down cost (while preserving function), and to get it ready for the market on time. Manufacturing works to hold down production costs and to put product on the shelves. Marketing has already been busy defining a protectable niche—either patentable or protected by some other barrier like technological lead time or the feeling that no one else will bother entering the market. Later, work starts on manuals, advertising, training.

The interfaces—between marketing and engineering and between the different engineers—are the critical areas where most problems arise, an executive points out. "The best way to break down barriers is with direct communication: Even at best, what a marketer writes may be a bit different from what he feels, and it may be interpreted still more differently by an engineer."

The key to success of the whole development is the product champion, who sees the process through from start to finish. This should be a marketing-oriented person with some knowledge of engineering and manufacturing. "And they are in short supply."

This executive would like to see more corporate involvement in the divisions' product-development activities. One possibility under consideration is appointment of a corporate new business development person, providing shelter for teams composed of a champion with others attached temporarily as needed, the way R&D people are now. This works well because it permits each R&D person to have an interest in several projects, and to allot time among them as needed. Also, if a project fails, the R&D person loses nothing, never having left home. Whatever is done, though, this executive would like to keep it informal, because: "Formal organization erodes informal organization, and it's the informal that accomplishes things."

The chart illustrates the problem of coordinating product development. A and B, are the places to watch. At A the technical development engineer (corporate at "Machineco") has to put a handle on the redesigned tool, and is encroaching on the product development engineer's turf. At B the product-development engineer impinges on manufacturing. The champion provides the drive.



Task Forces

Coordinating new product development by using task forces is very common among companies cooperating in this study. Companies use task forces to find new product opportunities (see p. 28), to carry out development after they have selected an innovation to pursue, to rescue developments that are bogging down, and for troubleshooting generally. Some task forces have leaders who behave like product champions; others are deliberately leaderless. Some are composed

Case Brief

Signode's Venture Teams

Signode Corp. is a $750-million private company, the leader in plastic and metal strapping systems, heavily engaged in industrial nailing and stapling guns and fasteners, licensing Dow Chemical Co. to make Ziploc plastic bags. New products are sought not because their core business is dying—it is good and solid—but because the company would like to grow faster.

Signode finds new products by using Venture Teams. "The idea is to bring good ideas to management for consideration," an executive explains. "It avoids having to pick one out of frustration and run with it just because you're tired of looking." It now has nine new business ideas at various stages, including one that is entering its third year with projected sales of $23 million, and one entering its second year with projected sales of $12 million. Here is how Signode does it:

(1) Define the company's strengths and weaknesses. This must be done *as of now;* not by going to the files and pulling out an old list. Bring outsiders in to help identify new areas of strength.

Signode discovered that its method of making plastic strap (cutting plastic sheets into strips) made it the world's largest manufacturer of plastic sheet; and that its sheet has twice the tensile strength of anybody else's. To look for new uses, it formed a Venture Team. This team ultimately developed an array of high-performance plastic products made from this sheet, including geogrids (plastic mesh of high tensile strength for holding together paved roads and abutments, preventing dirt slides and beach erosion, etc.), which are now in use.

(2) Define what you do and do not want and tell the Venture Team when it is founded. Should its product be sold to business or the consumer? Should it be aimed at a regulated industry or a less restricted one? Should it have a manufacturing or service orientation? Based on its examination of strengths and weaknesses, management must develop a strategy and define an area for the team to work in—plastics, packaging, transportation, construction.

(3) Select the Venture Team. Signode has used both part-time and full-time teams of four to six members each. They are from mixed disciplines—engineering, marketing, finance, manufacturing, and computer—as well as people with special expertise on the topic. All members of the team are drawn from the operating units.

"Get the best talent you have, otherwise it won't work," says an executive. It is not just that the best people will do the best work; top management will *listen* to its stars.

Signode appoints no leader for the team: "When the team hits a snag (as it will), if there's a leader, the rest will sit back and ask: 'What do we do now?' If the frustration is the group's problem, there will be six people involved in creative worrying, not just one."

(4) Set them to work "off campus," away from their regular jobs, and ask for no reports. Phase 1 of the Venture Team's activity consists of exploration and screening for about six months. At the end of Phase 1, Signode expects that the team will produce from two to four ideas suitable to carry forward into business analysis. At this point the team will be disbanded in most cases. Most members will return to their old jobs; probably one or two champions will continue with the ideas selected into business analysis and subsequently into commercialization

Phase 2 is a business analysis phase; and finally, after approval of a business plan, the project will be commercialized. "What we demand at the outset is that the team come back in six months with a good idea. We don't give them a chance to come back empty-handed."

(5) Show genuine management commitment. It is critical that the team be launched at a formal session with the CEO present. The CEO must be convinced himself—and must convince the team that this is not "an opportunistic sideline."

Signode figures a six-month venture team will cost $300,000 plus salaries. Early on, it brings in outside consultants to teach the team group dynamics—how to deal with factions, how to resolve clashes, how to prevent negativism.

Then the team members are urged to get into the marketplace, talk to customers. If they want a consultant, an expert, they should get the *best* expert, pay him for *two days;* "otherwise, save the air fare."

Some time between four and six months out a good Venture Team gets hit by "the spark of genius," according to the executive. "Do everything you can to help the team to generate that spark; otherwise it will be a me-too venture."

(6) Make sure all team members come out winners. "They can't all be champions and they can't all get promoted," an executive says. 'But if you want to get the next team, make sure the first group comes out with as much recognition as possible." In Signode's climate, venturers go back as conquering heroes. Being selected for a team is an honor.

Signode found that of the first six teams, five returned with at least one idea that is being, or will be, commercialized. This has been enough to put it into three major new businesses, with three more in the business-analysis phase. In addition, Signode will contract to set up other companies' first venture teams for them—for an honorarium, expenses and a percent of income from the resulting business.

An executive says: "Our view of the world is fairly simple: We think if you send six of your best people out to seek out opportunities in a specific area, there are good odds that they'll trip over *something*."

Case Brief

'Pure Products' Hits the Foundries

The Chemicals Division of the "Pure Products" Company used a task force to move itself into a promising, but entirely new marketing area. The Chemicals Division had been producing furfural and derivatives from agricultural wastes for more than 30 years. An independent profit center with functional units reporting to a general manager, the division had relied for its growth primarily on its strengths in process and product development. The division did very little applications research itself; most applications were found by customers.

New technology emerging from the division's research lab suggested a possible new use for its furfural products—in making sand cores and molds for the foundry industry. More work was required to confirm this, demonstrate its value, and communicate it effectively to an industry known for its resistance to change.

The task was clearly beyond the capability and experience of any one functional unit; yet success offered a chance to double or triple the division's business volume. Division management recognized both the challenge and the opportunity. So the general manager formed a task force and set it to work with the following charter:

(1) Conduct market research to quantify the opportunity.

(2) Gain a better understanding of current core- and mold-making processes.

(3) Develop test methods acceptable to the foundry industry to show potential economic benefits.

(4) Conduct field tests at major foundry locations.

(5) Define a market-entry strategy consistent with the opportunity and available resources.

The task force consisted of five people, pulled together from research, sales, engineering and corporate staff. Each member kept most of his basic responsibilities. The team members were in frequent contact, with formal meetings held at least once a month and informal visits in between. As the opportunity became more clearly defined, the members' workloads increased; and each drew more heavily on the resources of his own department. At this stage, team leadership became especially important. Not only was close communication among the team members essential, but the leader had to keep in close touch with top management, which was being asked to provide substantial "up front" resources for the development.

The task force accomplished its basic mission in about 18 months. A strategic business unit was formed, managed by one of the team's members. This SBU grew to become the division's largest revenue producer.

of part-time members, some full-time, some mixed.

Of 179 companies that responded to the questionnaire, 157 said they used task forces of one kind or another for new product development. Of the 157, 131 said they found them at least "somewhat effective," and 36 of these described them as "very effective" in coordinating development. They are used at many levels of the corporate organization. Typically, they are small and have little or no assigned staff.

A publishing executive injects a note of caution. "Task forces are a beginning, not an answer," he says. Not long ago, in response to a board request, a task force was formed to look into starting new magazines. The task force met periodically for several years, amassed information on what other companies were doing, discussed recommendations, and produced a thick report. Nothing happened because, by then, the board had forgotten the question. The effort expended came to naught, because the task force was a study group—not an action group. The executive adds: "A task force's mandate should not be, 'Write a report in six months,' but 'Have a product out by such and such date.' "

A technology and commercial development consultant with extensive task-force experience volunteered the following guidelines for their use:

(1) Use them sparingly. Teams should be formed only to achieve major development goals beyond the capability or resources of any single operating unit. This avoids diluting the impact of the task-force concept.

(2) Each member of the task force must understand the relative importance of his or her core responsibilities and the task force job. Just as important, so must the boss. Each member must expect that these dual responsibilities will mean extra work.

(3) Foster an atmosphere of freedom and creativity in the team. At the same time, provide corporate guidelines "up front" to point the team in the right direction and avoid false starts.

(4) Strong team leadership is important. The leader must keep members focused on the objective, use all their talents to best advantage, communicate effectively with corporate management, and provide the team with rewards and positive feedback as progress is made.

(5) When the task force's mission is accomplished, dissolve it. Try to promote effective team members to positions of greater responsibility in the new business area.

Commercializing New Products

Sometimes the task force that finds a new product becomes the cadre for the team that develops it. The electrical manufacturer described on page 28 took its task force's second prototype to the general manager of the consumer products division, but was told by the GM that competition was so fierce at that time that his division could not do the development justice. So a new division was created, staffed

Case Brief

Eastman's Bottle Plastic

For many years, chemical companies have been striving for a plastic material that would compete with glass and metal. The advantages of plastic are weight, safety and price; the disadvantage is that, unlike glass or metal, it is not an absolute barrier to carbon dioxide—so carbonated beverages go flat sooner.

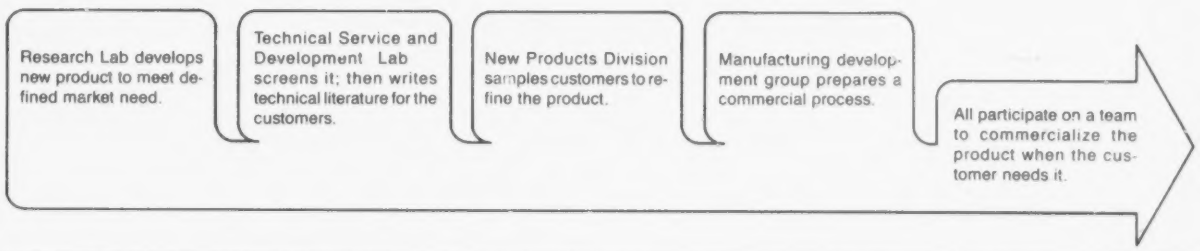
Eastman learned of a process for strain hardening polyethylene terephthalate by blowing air into it at a certain temperature to orient the molecules and enhance its tensile strength. A glass container manufacturer told Eastman that it would be interested in exploring the process, and preliminary talks were held among Eastman (as supplier of the resin), blow-molding machinery manufacturers, and the bottle company.

In 1974, Eastman set up a project team with the mission of developing the bottle polymer and commercializing it. The team was headed by someone from manufacturing, and included representatives from research, marketing and technical service.

Eastman had capacity to make the resin in place, but it lacked blow-molding technology. Fortunately for it, machinery companies had advanced their technology to the point that Eastman could obtain the information. At the same time, the Eastman team was developing a marketing plan. The marketing organization was geared to selling resins, but not to bottle manufacturers; so a new group had to be established in the Commercial Division to develop customer relationships and handle sales when the project became commercial.

On commercialization, the project team disbanded. Two team members went to the new group in the Commercial Division. All the rest of the marketers and all the technical people returned to their previous jobs.

The Commercial Development Channel at Eastman


Research Lab develops new product to meet defined market need.
Technical Service and Development Lab screens it; then writes technical literature for the customers.
New Products Division samples customers to refine the product.
Manufacturing development group prepares a commercial process.
All participate on a team to commercialize the product when the customer needs it.

with the technical and marketing people needed to develop it fast—several of them from the task force. Once the new product has proven its acceptance in the market, the division will be fully staffed—manufacturing, sales, all that is needed for successful operation.

At one major chemical company, a new-business-development executive coordinates research and marketing informally in the early stages. If the Operating Board (headed by the appropriate product manager or business director and including people from marketing, R&D and new business development) thinks more detailed market research and market testing are justified, a project team—headed by a new business manager—is appointed.

As the development progresses, the project team reports back to the head of the Operating Board; and if the report is exciting, the project is sent to the Growth Committee (consisting of all the general managers and headed by the managing director). If the Growth Commitee likes the idea, it can approve major funding—sufficient to carry the development through pilot. The project team remains the nucleus of the development, and often its leader becomes the leader of a new business unit upon commercialization.

Commercial development task forces vary widely in composition, the common denominator being "who is needed." But one often finds on them representatives from research, sales, engineering and corporate development.

USG's development of Durock cement board was carried out by a pragmatically organized group. Early research work had been done by the champion on fast-setting cement; and he transferred this technology to a continuous board-making process, drawing from gypsum-board technology. From the time the champion got the plant process worked out, it was carried to completion guided by a variable eight-man task force, most of them working part time. The members: (1) The Senior Vice President Science & Technology; (2) a representative of manufacturing; (3) and (4) two cement chemists, who had been brought on for the job: (5) the head of the construction systems lab; (6) a Vice President Marketing; (7) the champion, who worked full time; (8) a marketing man, also full time, who became division manager when Durock was commercialized. All but the last two did their regular jobs, came to periodic meetings of the task force, and performed assigned tasks relating to the Durock development between meetings.

Case Brief

PPG's 'Sungate' Series

The philosophy at PPG Industries is that new product development does not "upgrade commodity products"; it "adds value by using commodity products as raw material." Years of experience in the glass business, coupled with continuing market research and customer contact, convinced Glass Group's management that a need existed in the market for windows with better insulating value.

Since most windows are now double glazed, a natural "upgrade" of the flat glass commodity might have been a move to triple-glazed windows. This would have increased the market for the commodity by 50 percent at one stroke. But its "value added" philosophy made PPG reject this approach out of hand. The homeowner wants a window that is light in weight; furthermore, the consumer prefers clear glass over the reflective insulating glass used in commercial buildings. The sash manufacturers (whom PPG refers to as "intermediate customers," even though they are the ones who buy from PPG) are still more interested in light weight; and they would prefer double-glazed windows, because they would have to retool for triple glazing.

Glass Group's R&D approached the problem of designing a coating that would provide the insulating valve without adding weight, and would leave the window clear, on two parallel paths. Two technological answers were found and both have been implemented.

Sungate 100 is built around a vacuum-process coating for a hermetically sealed unit. The coating is invisible; it reduces ultra violet and reflects infra red coming in, so direct heat gain from the sun is reduced; and it reflects internally generated heat back inside the room. But the coating has to be in a vacuum or it would be used up in 20 years or less.

Despite the technical problems presented by the vacuum requirement, a PPG task force of researchers and marketers, working closely with customers and "intermediates," carried the development through the pilot stage and produced enough product to go to full commercial production in 18 months. Initial pilot and commercial production used an existing facility for making reflective products. Diligent efforts to improve and enhance Sungate 100 during its introductory phase yielded a product having high durability, ease of handling, and a shelf life exceeding six months—all attractive features to sash and window manufacturers.

Sungate 200 gets away from the vacuum requirement. The coating is fired onto the glass at high temperature during manufacture. Compared with the vacuum-produced product, it offers more durability, easier handling and a capacity to be heat treated—all important qualities to the "intermediates." But it was impossible at the then-present state of technology to make the Sungate 200 coating look completely like clear glass.

Glass Group management set up a task force, with the R&D people who had worked on it at bench level charged with overall responsibility all the way to commercialization of the product. Other components of the task force were added as they were needed: R&D from the start, peaking with the pilot, then building to introduction; engineering and manufacturing phasing into the project as their services were demanded.

The task forces at PPG are held together loosely. Nobody is "tsar"; there is no pecking order. Reports are made only as needed. Most of the work is coordinated through the normal management structure.

An executive explains: "The key to our task forces is overlap. Traditionally, a project goes from bench to process to project, to marketing—like a relay race. Here, we don't just pass the baton. This saves time and enhances cooperation: The *customer* is the boss; the task force just works together to reach the objective."

Upon completion of its mission, the task force is dissolved, and Glass Group's regular sales force starts selling the new windows. Marketing has provided selling materials and advertising; manufacturing is making the glass. There is no thought of starting a new unit to handle the new products; the regular functional groups have worked together on them from the start.

The task force members at a consumer goods company are all assigned part time and work informally. Work is funded out of the member's budgets, which are ample for the purpose. A typical task force might consist of an executive vice president, the corporate controller, the Senior Vice President R&D, a general manager, the Vice President R&D, the Market Research Director, and a few market researchers. Manufacturing is not represented. The task force meets as needed. After one meeting, the members decide what should be done before they meet again and assign tasks. In between scheduled meetings, members gather informally in an "iterative process."

The give and take and informality of this company's task forces are also illustrated by one that was headed by a market-research manager, with his general manager serving on the task force under him. This is not a rare occurrence, and it is encouraged. One division manager whose product had been discontinued was asked to head up a task force to explore development of another product. He put together a 25-person task force in a 10-person division—with the other members chosen from group and corporate staff: "We want all members of the task force to make inputs, we don't need inspectors." ("It's easy for top managers to play 'inspector,' " says an executive, "but it's not very productive.")

The case brief on page 43 illustrates how Eastman Chemical marshalls its resources to commercialize new products through a "project team" drawing temporary help from many functional groups.

Case Brief
Cooperation at 'Waterchem'

"Waterchem" is a successful specialty chemicals firm with several business units reporting to a lean corporate headquarters. R&D is under corporate; each business unit has its own sales, marketing and technical service resources—and a demonstrated capability to serve its markets well.

R&D developed a polymer with promise in a growth segment of a market that was already being served by one of the business units. The BU would not cooperate in field testing it—out of a long-standing feeling that "nothing of practical value ever comes out of research," and an unspoken concern that the new polymer would complicate sales and risk upsetting a comfortable (but relatively unprofitable) market position. This incident brought into the open an attitude that had prevailed for some time in all the BU's—thwarting new product development in all areas related to "Waterchem's" core businesses.

Management set up a task force to commercialize the new polymer. The task force was given the option of aborting the project if further market research testing failed to confirm management's earlier optimism. The six-member team included two people from the affected business unit, both of them carefully chosen for their competence and open mindedness. Other members came from corporate research, corporate development, and manufacturing.

The first task was to gain a balanced understanding and consensus on the new technology's potential value. The next was to identify the problems requiring solution *before* proceeding with field testing and market development. This required several meetings.

Intital progress was slow, because of past animosities. In three months the team agreed on the key technical, marketing and sales inputs needed before testing. Most important, each member agreed to specific time-targeted tasks that he would accomplish by drawing on the resources of his unit.

In seven or eight months, after positive field tests, the project moved into test marketing and development of a national entry strategy. The commitment of manufacturing to overcome scale-up problems on a tight schedule was especially noteworthy.

The sense of mission and the spirit of cooperation that had developed in the task force carried the project to commercialization in 15 months. Starting as a new segment of the originally troublesome business unit, it evolved later into a separate BU. The experience set a precedent for cooperation and also led to organizational changes that improved the climate for innovation at "Waterchem."

The Glass Group of PPG Industries, Inc., uses task forces, too: They flow from the regular organization of the Group. PPG's task force members are phased in and out of the project as needed; but, instead of being driven by a champion, the development is carried on under the aegis of the line-management team. The case brief on page 44 shows how the system works.

Case Brief
A Rescue at 'Seagel'

"Seagel Chemical" successfully introduced a new product that moved it quickly to the top of a growing specialty chemical market. Before long, however, larger competitors recovered from their initial surprise; and they countered with products approximately as good as "Seagel's," and with aggressive pricing. "Seagel's" sales kept rising, but its market share fell. Finally, a sudden drop in sales as market growth began to level off focused management's attention on the problem. Management's diagnosis was that the product manager, while technically astute, lacked the skill to manage effectively as competition heated up.

"Seagel's" response was to form a task force consisting of managers from corporate sales, marketing, research and operations. Each member was responsible for a clearly defined segment of the business problem. Their joint task was to meet with major customers, past and present, and learn first hand what would be needed to restore "Seagel's" earlier positon. "Seagel's" reputation assured them a welcome. And customers were impressed by being visited by corporate managers who obviously cared about their business.

Findings of the task force revealed opportunities to regain market share with minor product modifications and an improved distribution network. These were implemented, and follow-up meetings were held with customers.

"Seagel" increased market share significantly through the task force's action, but did not totally regain its former position. The task force was dissolved after about six months, and the management of the business unit in question was restructured.

Troubleshooting

Another common use of task forces is to solve business problems or technical problems that arise in the course of development. For example: A fire at the plant of a prospective customer gave a specialty paper company an opportunity to win the account if it could supply 250,000 pounds of material in three weeks. In a "crash program" it established a task force composed of a project leader, a man from business planning, two people from manufacturing, and the quilty-control manager. Meeting twice a week, they hammered out a schedule for a multiple-step production process. In three weeks the mission was accomplished, and the task force was disbanded. As a result of its fast response, the company became the sole supplier to this customer.

A pharmaceutical firm's research director uses task forces often and to good effect—usually to solve a specific problem that people assigned to the project are not solving. This is

Case Brief

Commercial Development at Air Products

Air Products and Chemicals, Inc., got its start in industrial gases and diversified into chemicals about 1960. By 1980, chemicals were about one-third of corporate sales. Within the Chemicals Group were four divisions, each one organized into business areas. Each business had a product management function, a marketing function, and a small business-development function. Business development did not get much attention from the business area managers because their time was generally consumed in dealing with near-term operations.

To participate in the innovation wave of the time, in 1981 the Industrial Chemicals Division reorganized, assigning all the business-development staff from several business areas into a new Commercial Development function. (See chart.) Other divisions in the Chemicals Group have followed suit. The result has been a more effective commercial development effort.

In Industrial Chemicals, the Director, Research and Commercial Development, is responsible for R&D as well as Commercial Development. Ideas funnel into Commercial Development from many sources. Thence the progression is to the exploratory stage, then to development, semi-commercial, and, finally, commercial. But only a few ideas move forward from one stage to the next. Commercial Development shepherds them through to commercialization, and then they are turned over either to an existing business area or to a new business area. The Director, Research and Commercial Development, uses a computerized "innovation monitoring system" to help manage this process.

There are a number of Commercial Development teams, and each one of two to four people has responsibility for a number of projects in various stages. A team may have one "semi-commercial," almost ready to turn over to a business area; one "developmental"; two or three "exploratories"; and, perhaps, five in the backlog. Each project has a resource plan and associated milestones that have been used as a basis for the development budget. Milestones are included as standards in C D personnel performance evaluations.

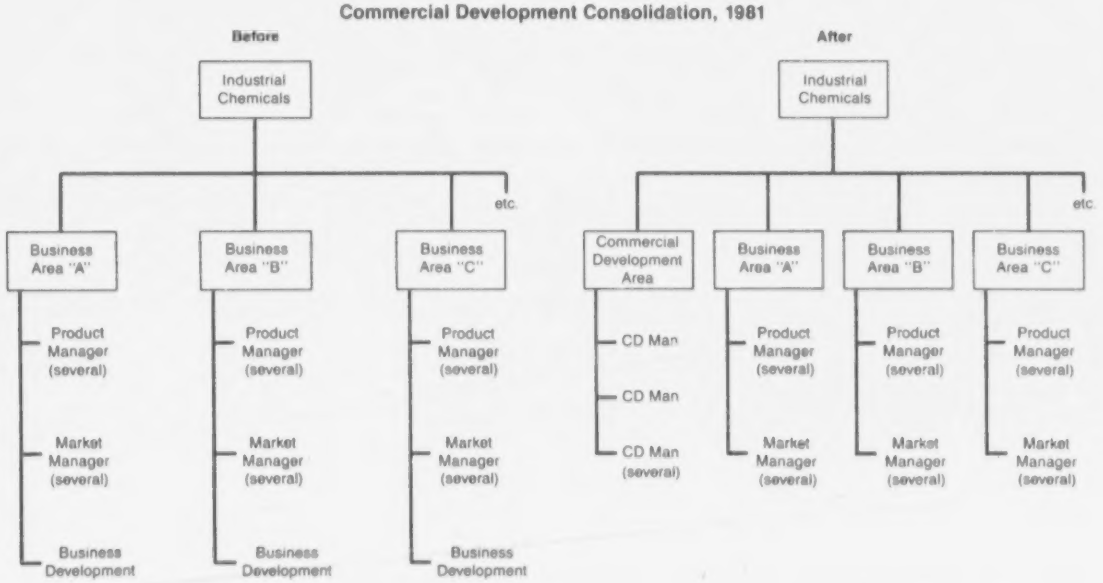
For developments in the later stages, the milestone may be events that should take place by a given date. For "exploratories," milestones may be dates for decisions to be made; for the backlog, milestones may be numbers of ideas to be promoted to exploratory or dropped by a target date. The Director asks each C D person to write his own milestones, and finds himself applying pressure on the conservative side.

The computerized system gives every idea a name when it enters the backlog. By turning on the computer, the Director can see the name of the idea, the name of the person assigned to it, and the next milestone. The Director believes strongly that the innovation process must be managed:

"Many inventions are tangential to the original target," he says. "If you can define a market need and put a group of competent researchers together focused on filling the need, they may not discover what you sent them after, but they will generally find something of value. If you put the same group together without a clear commercial goal, the chances are they won't find anything useful."

Since the 1981 reorganization, Industrial Chemicals Commercial Development has commercialized several new products and has effected one acquisition.

Commercial Development Consolidation, 1981



Case Brief

CD on a Shoestring at CasChem

CasChem Inc. is a private company (the old Baker Castor Oil, plus a few additions), dealing primarily in castor specialties and special urethanes, with annual sales of less than $100 million. Division marketing managers spend half their time on current businesses, half examining their markets for new applications.

The Vice President Commercial Development has no department. He is a one-man cost center (at $50,000 a year for travel and contract research), reporting to the President. He looks outside the company for new product ideas, which he implements by selling them to executives within the company.

At CasChem, development costs (the VPCD's salary and budget) are paid for by the divisions, but individual programs are not broken out. In this way, divisional management does not focus on individual program costs, but on overall performance. And some charges are buried elsewhere, as the VPCD enlists someone's cooperation. "Commercial Development on a shoestring" is what the VPCD calls it, but he would have it no other way. He cites two prerequisites for successful product development, both present at CasChem:

(1) The technical-marketing interface in CasChem's product development "runs right between my eyes," he says. The only way to do commercial development, in his view, is through someone who knows both the technology and the markets.

(2) The CD manager "must have the CEO's ear," and this means that he must report to the president (or perhaps an executive vice president in a very large company).

"The worst way to run a development activity is to make the divisions pay for it piece by piece. They may not feel like buying. At the same time, the divisions ought to approve the business plan, to understand from the start that they will be taking the product over when it starts making money."

Revenues resulting from development go to the divisions. This helps the CD manager get cooperation, and helps him get development into the division's annual plans. (It does not cost the divisions anything, so they are inclined to consider the new products.) "When the product is fully functional, the division can squeeze every nickel out of it; but until that time the focus must be on market milestones—not profit."

When the VPCD joined CasChem, the CEO gave him a blank slate to figure out what he ought to be doing and to scout up some development projects. The first thing that struck the new CD manager was that CasChem had a good telecommunications business—but all its products were designed for copper cable, while the telephone companies were moving to fiber optics. So he focused on optical fibers—talked to customers, CasChem marketers and technicians, attended meetings on optical fibers, read the literature, and at length came up with suggestions that led to the development of a buffer gel for fiber optic cables.

Another idea—for lypase enzymes—just sprang into his head as he considered match-ups with CasChem's markets. He is now working with a biotech company that makes enzymes from fats and oils, and considers it a good match: The biotech firm makes the enzymes; CasChem provides the marketing expertise.

The VPCD talks constantly with CasChem's marketers, helping them to develop new applications. "The ideas come from them; I just stimulate them." If something is beyond the capability of the Research Department, he can set up a program at a local university laboratory.

not resented, but is seen as the application of some needed resources by management. Sometimes the help is requested. As an example:

The cardiovascular group was working on an anticlotting drug. One batch worked; the next did not; several times the group failed to duplicate the good batch. The research director took the whole project off the line and assigned a task force composed of some of the people who had been on the project and some others who had not. The mission: "Solve the problem or drop the project."

Sometimes the project's champion is assigned to the task force, sometimes not. Sometimes the leader of the task force is asked to write a plan; sometimes he is just given a deadline for reporting results. The idea is to focus attention and resources on the problem, and it has worked well. Often, consultants are assigned to the task forces. This way the vice president can select the right in-depth expertise, rather that relying on his more general in-house talents.

Another example involves an orally absorbable chemical that was already in the clinical test stage when it was discovered that its absorption rate was extremely variable. In this case, an international task force of scientists from the U.K., France and the United States was formed. Working in the company's British laboratories, the task force is making progress. The project has been placed on hold in the meantime.

Two other companies' use of task forces to respond to emergencies are described in the 'Waterchem' and 'Seagel' case briefs on page 45.

Commercial Development Units

About one in three executives cooperating in the study report that their new-product activities are carried on in a separate commercial development unit. Field interviews made it clear, however, that the term "commercial develop-

Case Brief

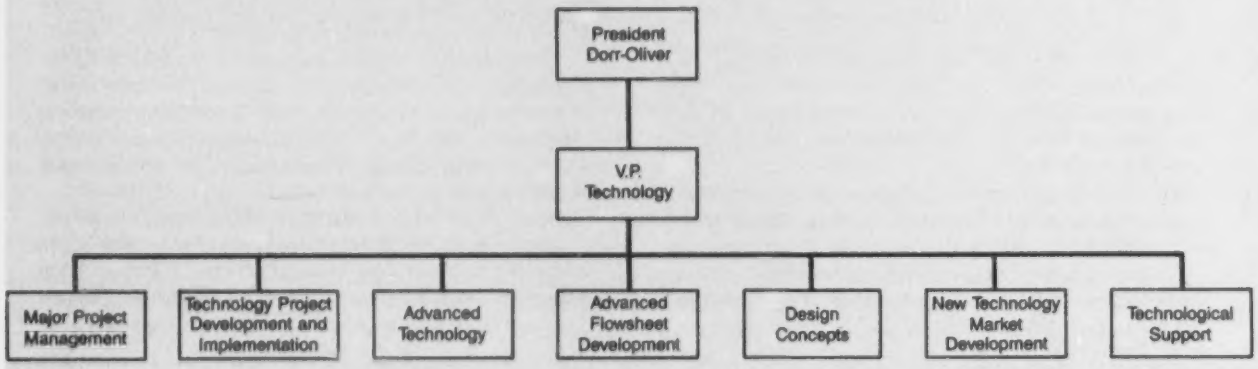
Structured Innovation at Dorr-Oliver

lines into two divisions and created the position of Vice President Technology, to accomplish development and market introduction of new products. Responsibility for product improvement and line extensions rests with the divisions, "where the skills are." The new technology organization has about 60 people and is responsible for developing new products for existing or new markets. It is organized on functional lines.

Ideas for new products are ramrodded through to commercialization by project teams, whose leaders are chosen form the technology organization and whose leaders come (full-time or part-time) from the functional departments. For example: an Idea Evaluation Committee composed of department directors decides which ideas are worth pushing into the development process, orders their priority, and may assign a project leader to the best ones.

In 1981 when Standard Oil of Ohio acquired Dorr-Oliver (a leader in process equipment, with many years of experience in fluidized bed technology), Dorr-Oliver management felt that the market for environmentally sound coal and other fluid bed boilers would be promising. Not having any boiler experience, Dorr-Oliver proposed to its parent the acquisition of the E. Keeler Co. This resulted in the formation of the Keeler/Dorr-Oliver Division of Dorr-Oliver. This group makes fluidized bed boilers that can burn high-sulfur coal, coal mine waste, oil shale, tar sands, agricultural and industrial wastes—and still comply with EPA emission standards.

In 1984, Dorr-Oliver hired the consulting firm, Ayers, Whitmore & Company, Inc., to help devise a methodology for more rapid new product introduction. The consultants proposed a new organization put the major product



ment unit" means different things to different people. About the only thing these units have in common, in fact, is the mission of expediting product development.

The case briefs on pages 46-50 show the wide range of approaches to this mission. Air Products and Dorr-Oliver have structured and amply staffed departments to carry out the development process systematically. Caschem and ICI Americas have minimal staff, minimum structure, and maximum free wheeling. All four systems appear to work well.

The point is that these commercial development units—like ad hoc new product groups assigned to marketing or R&D or planning—depend for their success not so much on their organization as on their people and the climate in which they work. As noted, the term, "commercial development," originated in the chemical industry, but the function of coordinating the efforts of R&D scientists and technicians, engineers, manufacturing people, and marketers takes place in every industry that develops new products and brings them to commercial use. The study suggests that this function (and hence the skills needed to perform it) is growing in importance as competition intensifies and product life cycles shorten.

The CD Manager: A Composite Portrait

The blend of technical and marketing skills, plus a background of solid management support, emerges from the study as a key to successful development of new product. Five characteristics recurred so frequently among the most successful (or, at least, the most self-confident) of the new-product executives interviewed that they warrant attention.

Multidisciplined. The background of a commercial development manager is "like a three legged stool," one says. It should include experience in research, marketing and manufacturing. "I look for all three; but if you can find two,

The leader gets an intial research allocation and begins to work his way through Dorr-Oliver's development process.

To help hold down development time and make screening more efficient, the development process has been structured into seven phases:

(1) Idea generation
(2) Initial business plan
(3) Requirements definition
(4) Comprehensive business plan
(5) Development and testing
(6) Full-scale demonstration
(7) Market introduction.

The project team's composition is based on need. In the early phases, the leader may be assigned to it part-time; and the others, drawn from the six functional departments, may be splitting their efforts among several projects. As the idea progresses through the system's phases, additional time and additional people with the knowledge and skills required in that phase are assigned to the project team.

The project leader's first task is to write an initial business plan. Then he defines his requirements, reports the market niches to be filled, the product's attributes, his targets. He progresses through a series of "phase reviews." If the review committee continues to think the idea is feasible, it authorizes more funding and tells the project leader to prepare a comprehensive business plan. "That's where money starts being spent: on development, testing, scale-up, proto-typing, redefining markets—the total scope of the project," an executive explains.

The phases that follow are reviewed by the committee to determine: (1) Is the project on target? (2) Detailed plan for the next phase (allowing changes—sometimes extensive changes—in the comprehensive business plan based on experience); and (3) Funding for the next phase. The purpose of the phase reviews is to avoid perpetuating projects that are just not working out. They can be cut off—and some have been—by the review committee or by the project leader himself, if he finds an insurmountable obstacle.

The whole flow of ideas is orchestrated by computer, with manpower allocation optimized for all projects. A print-out shows ideas grouped as advanced ones, with leaders assigned and resources allocated, and early ones, unassigned and constituting a backlog. An advantage of Dorr-Oliver's system is the flexibility of action possible under its seemingly rigid structure. A small project team may be staffed with part-timers throughout its life. A big one may have a half-dozen full-time people for three years. When a project emerges at the end of the development process, it may go to either an existing division or to a newly established venture.

The Vice President tries to force conflicts out into the open, where they can be faced and resolved, early. At one meeting, the product developer predicted it would take two years to get ready for market; the marketing man insisted he had to have it in one year. The issue was discussed thoroughly by members of the team representing all functions, and the compromise was: One year, but with more risks being taken in development.

"It's important to get a product out on the market quickly," the Vice President says. "Then you can learn if it needs changing and change it. I'd rather have a fast first-generation product followed swiftly by a corrected second-generation product than try to perfect the original under short-of-market conditions."

Dorr-Oliver's system of structured innovation is still changing and developing. "There still can be interdepartmental rivalries, champions competing for people. Our frequent meetings bring them out in public. Today, the departments and project leaders sort out their differences in public at committee meetings; later we hope they'll do it informally on their own."

it's not bad." His own background includes research, plant management, and business management. Many also have planning skills; several, in fact, designed their own development jobs while working as planners. Another's mix: R&D, technical planning, financial analysis, strategic planning, process planning.

Technical education is a common denominator; the other disciplines often are acquired by experience. Nearly all these people have engineering degrees at the bachelor's level. Many have advanced technical degrees as well; and many have graduate degrees in business administration. A few have law degrees.

Line experience, as well as staff experience, is common. For some, this means having run a large research lab; for others, an operating division. The latter is preferred, especially in companies where the development can turn into a division after it is fully commercialized.

The job description of one company's senior commercial development officer sums up the desired background this way:

"Education: Bachelor's degree in technical field (science and engineering). Graduate degree in business administration—marketing concentration or comparable experience. Specific courses or areas of study should include chemistry, chemical engineering, related sciences, economics, marketing, management (at graduate level), to name a few.

"Work experience: At least 20 years' combination of experience in operations, engineering, marketing, market research, planning, R&D, or other related areas with at least 10 years of experience in the new business development process."

Enterprising. Successful commerical development people seem to thrive in a loosely structured, "free-wheeling" ambience. They tend to be pragmatic, a bit restless, and outwardly directed. To his delight, one development executive

Case Brief
ICI's FORTIGLAS™

FORTIGLAS, a line of heat and flame resistant products, grew from an ICI research program that was looking for inorganic materials to do what organics do. One line of experiments sought a replacement for asbestos by looking at layered inorganics—platy clay, slate, mica, vermiculite—that could be treated chemically and laid on glass. The result was a material with these characteristics: Heat stability—less than 1 percent linear shrinkage at 1,500°F for one hour. Flame barrier—resists burn-through in excess of 30 minutes of direct impingement of Bunsen burner flame at 2,200°F.

In Europe, ICI decided to license the technology for a royalty. In the United States, ICI Americas' New Ventures group decided to carry it a bit farther. It studied the technology and the British economic analysis, measuring it against the U.S. market. Since ICI Americas does not sell to the thermal protection market, it solicited leads into the U.S. electrical industry from its Film Group and into the Federal Aviation Administration and Department of Defense from the people who sell firefighting chemicals. The venture group carried samples around on calls, studied markets and cost structures in the United States, and gradually came to understand the U.S. market for FORTIGLAS.

To assure technical follow up, it talked for six to nine months with coated glass manufacturers and learned, among other things, that the Environmental Protection Agency would approve FORTIGLAS made with vermiculite containing no asbestos.

Thermal glass is divided into two technologies—woven and nonwoven. The woven market called for licensing, the venture group decided. It was relatively small—welding, electrical sleeving, gaskets—and had to be reached by a company in the textile business. The recommendation was approved, and ICI sold the technology to three licensees for pre-paid and running royalties.

The nonwoven market looked larger—construction materials, aircraft, cable wrap, non-ferrous metal processes, molded glass. Here the New Ventures group recommended a different approach: ICI would manufacture the coating in Britain and ship it to the United States, where ICI Americas would convert it to FORTIGLAS; two distributors (one of them Manville Corp.) as well as ICI Americas would then sell it. Typically, the coating would be shipped to a contract manufacturer, which would apply it to Manville's mat; and then it would be sold through Manville's distribution network. The contract manufacturer offered a favorable price because of its relationship with Manville.

Manville still has not got the product to its line salesmen, but ICI Americas' Manager of New Ventures is not discouraged. All hands are moving very slowly to avoid mistakes. "It takes six years for a new product to become a business, after the product has been identified and its utility demonstrated," he says.

The Manager of New Ventures has had FAA test FORTIGLAS in the hope that the agency will upgrade thermal standards for products used in aircraft manufacture. FAA has a standard test for cargo compartments: a five-minute burn at 1,700°F with a thermocouple on the other side of the material registering not more than 400°F. The FAA test can be taped on a video recorder cassette, which will be carried around and shown to aircraft manufacturers to induce them to test the material in their own laboratories.

New Ventures also is looking for "case histories," especially in the construction business. It is trying to arrange for builders to use FORTIGLAS on doors or walls.

The plan is to keep importing the coating until the U.K. plant is close to capacity operation, then switch to U.S. manufacture. New Ventures has located a plant site and worked up cost information, which will be compared with toll manufacture to determine the most economical route. Later, when the project has established enough sales to carry itself, New Ventures will try to sell it to a U.S. division. If not, it will close down the manufacturing and license it for the U.S. market.

If the project is successful and moves to a division, the project manager will probably go with it. The Manager of New Ventures would find his replacement, probably one qualified in an area that is under investigation at the time.

was hired and set to work by his CEO with a two-word job description: "Change things!" Another left the patent department of a large corporation when reorganization threatened to pull him in from the laboratories and plants and keep him "cooped up" with his law books. A third got into CD as an escape from an "ivory tower" corporate research laboratory.

"You have to look for ideas outside the corporate mold," says one executive. To help him, he signs on "entrepreneur-type" people who have run businesses and can bring a new viewpoint to the company's development effort. Others stress the need to get out and learn about the customers, and the customers' customers. "Find out their cost structures," one says. "Statistical, 'macro' approaches are worthless; learn all about the individual," says another. Nearly all have active, searching minds.

Diplomatic. Developing new products in a decentralized company also requires diplomacy. Even the best connections with top management do not permit corporate staff officers to run roughshod over the line managers of subordinate units. One new products executive has an "inside-out R&D system," relying on helpfulness and subtle suggestions, which is described in the next case brief. Another, who warns of "the corporate staff imprimatur," explains that his job is first to

convince the CEO and other senior officers at corporate headquarters that he has a good idea, and then to turn his attention to convincing the division general managers. Sometimes he exposes them to an idea for 18 months, and then is amused to hear a GM eventually suggest the idea as his own. Another deprecatingly describes himself as a "cheerleader"; and still another describes his activities as "trying to influence the divisions in gentle ways."

Well Connected. The most effective commercial development executives are close to top management—if, indeed, they are not a part of top management themselves. But the CEO is not their only important contact. "You must understand your own organization to get things done," one says. This means "knowing everybody in the company," he adds, and he feels that either he or a member of his small staff does know everybody.

Connections outside the company also are important. Participation in trade and professional organizations, attendance at meetings, and what one executive calls "an astronomical phone bill," are cited by several as valuable sources of ideas and potential technology acquisitions. One CD manager has established a reputation among inventors that keeps his plate filled with potential developments. "Once the word is out that you're serious and know what you're talking about, it gets around," he says.

Energetic. Edison's definition of genius as "one per cent inspiration and ninety-nine per cent perspiration" still appears to be apt in the CD milieu. Earlier pages have provided abundant examples. A veteran C D manager provides still another illustration of the way an energetic and resourceful individual can make the difference between success and failure of a product:

Some years ago a large chemical company's research department developed an improved formulation of butyl rubber, with high air retention and good compatibility with other rubbers. Congratulations all around! This was just what the tire companies needed.

The company built a pilot plant and sent the new rubber out with the sales reps. The reps were not so impressed; they had their own established line to sell, and no time to push an untried product if they were to make their quotas. So the product flopped.

Enter the market development man. He did missionary work, calling on the chief chemists in the rubber plants. His own company's research staff was so occupied with other work that he had to go outside to get tests run to have data for the customers. He shopped the results around, supervised the pilot production himself. Finally, he got one rubber company to use it, and it worked. Others came in. "It takes perseverence. Working salesmen don't have time."

Development as a Line Function

At the other extreme from the companies with separate commercial development units are a few that deliberately avoid interposing staff people into a function that they consider a line responsibility. At Amstar, for example, the division presidents or business general managers have line responsibility for "the research-marketing interface"; and they accept it as a matter of course. Amstar's line managers realize that they must keep developing products (improving them might be a better word) not in spite of pressure for profits, but in order to produce the profits. There is apparently no conflict, and no need for a Commercial Development unit.

At Analog Devices, corporate headquarters provides some services but has little to do with what goes on in the divisions. A striking feature of Analog is its lack of committees.

Case Brief

'Inside-Out R&D' in a Decentralized Company

At this decentralized, diversified industrial products company, all research and development work is done in the divisions. Although there is no R&D at the corporate level, the CEO is determined to stimulate the development of new products and new businesses—and this means stimulating the division general managers to innovate.

Besides encouraging the division managers directly, the CEO helps innovation along by working through a senior technical officer on his staff. This officer has what he calls an "inside-out" R&D system. He is convinced that he cannot force the divisions to handle developments the way he thinks they should be handled by making direct suggestions, because "nobody ever wants to hear anything from corporate." So he gets his ideas into the divisions indirectly.

For example, he has three people who provide free help to the divisions because they are, in part, on his payroll. A full-time quality director, on corporate payroll, spends half to two-thirds of his time working with people in the divisions. An electronics engineer draws half his pay from corporate, half from a division where he spends all his time. A mechanical engineer draws half his pay from corporate, half from his division. He spends time roaming throughout the company, lending a hand where needed.

When the technical officer felt some misgivings about the way one new product development was progressing in one of the divisions, he discussed it with the CEO. When the CEO told the division manager that he thought he needed help, and would be willing to provide some, the division manager formed a task force of the three "inside-out" engineers—asking the technical officer's permission, which was freely given.

A consultant also has been working on the development in question, and he and the senior technical officer are convinced that six weeks of the right direction of effort would solve the problem. The division manager, however, is not; he wants to get rid of the consultant. The jury is still out, but the chances are that the technical officer—sitting on the right hand of the CEO—will find an "inside-out" way to get his point across.

Case Brief

Coordinating Development at 'XYZ Pharmaceutical'

Coordinating development of a new drug at "XYZ Pharmaceutical" is a process that starts very early. The research unit writes a brief Product Profile and asks Marketing's opinion on commercial potential. If study suggests an affirmative answer, Marketing sends back a Statement of Interest, and the dialogue continues until Marketing expands its Statement of Interest and begins pulling together the Marketing Needs Report, detailing what is needed to market the product optimally.

This is a balancing act involving size and quality of market, money to be spent, and time required for FDA approval. Selling a pharmaceutical is not just selling the product; it is substantiating the label and providing back-up for the claims to be made. The more comprehensive the claims, the more tests required and—still more important—the more time for FDA to act. These are the variables that marketing evaluates (sometimes using computer simulation) in writing the Marketing Needs Report.

For example: a drug may have properties that could make it both an anti-inflammatory and an analgesic. If Marketing asked Research for studies to prove both, it would mean more time and money spent in the lab and much more time at FDA. Marketing must examine all the angles: It might be better to introduce the drug as an analgesic, get it approved and on the market, and *then* do the studies to support its use as an anti-inflammatory.

When R&D gets the Marketing Needs Report, it sets to work to produce the Clinical Operating Plan when the product is ready for testing on human patients. Marketing then reassesses the product and makes a 10-year market forecast. All this time informal and formal meetings are continuing between Research and Marketing and a consensus is forming.

When the Marketing Needs Report and the Clinical Operating Plan are both on paper, Research and Marketing hold a joint meeting to negotiate what studies are to be done. To illustrate, Research might take a blood pressure reducer and suggest that it substantiate only that it reduces blood pressure and is safe; that would get it through FDA relatively easily. But Marketing points out that it would be hard to sell, because it would then be no better than the competition. Through this meeting and on through the in-depth reviews that follow, Marketing and Research hammer away to reach consensus, with the Corporate New Product Committee—chaired by the President as ultimate arbiter.

If Marketing says "No" to a product and Research says "Yes," the New Product Committee also arbitrates. (This may only happen half a dozen times among the 100 new compounds a year that reach this stage of development.) Suppose Research sees the work as the leading edge of a possible breakthrough technology, but Marketing sees problems: It can't be administered orally, which makes it hard to sell; it can't be patented; and it isn't much more effective than competing drugs. The Corporate New Product Committee may decide it is worth pressing ahead; but if so, it will be with the realization that the cost of research may not be paid back by sales.

This process helps create a good balance of science and marketing. As research progresses and assumptions change, Marketing keeps changing its forecasts to reflect new situations. Frequent meetings assure that neither will stray far from practical development efforts.

All R&D is done in the divisions, most of it in the normal course of business. Division marketing coordinates commercial development, such as it is, with a strong assist from line management. The Manager, Strategic Information, at corporate headquarters, acts as a "cheerleader and persuader," but the line manages development.

One of that manager's activities is to emphasize the importance of product development. He contributes to a quarterly meeting at which he traces the results of previous development efforts: What percent of bookings are new products; trends in the new/old product-sales ratios. He tries to find problem areas "before the problems happen," continually sends around memos with the result of studies "assessing the quality of results." None of this is done to relieve the division general managers of the burdens of new product development: It is done to remind them to shoulder the burdens themselves.

At a leading drug company ("XYZ Pharmaceutical"), product development is an integral part of the line organization's work—as shown in the case brief above. From a chemical company, another believer in line management of commercial development explains: "The general manager himself is the ultimate keeper of both day-to-day operations and developmental planning. Calling somebody a commercial development manager and placing him in a staff capacity between the day-to-day and developmental aspects of the business doesn't work. CD can become an epi-judgment center, opposite the general manager, or a decision buffer for him. In either case, the result is a disaster.

"The CEO of a small, developing business does commercial development work every day, because his whole business is in development. The crunch comes later, when establishd products contribute profits—and new ventures contribute losses and risk. Then it is tempting for the CEO to delegate the development of the business out of the line to a clever and personable guy he calls the CD manager. But that guy doesn't have the clout to do the job. Good development must emanate from the CEO. He's the one responsible for quarterly results *and* the long-range good health of the corporation."

Chapter 7
Organizational Approaches

New-product activity is carried out at every level of business organizations—corporate, group, division, business unit, and many combinations thereof (Table 1). Among the companies cooperating in this study, responsibility for new products is lodged with managers bearing titles from president on down (Table 2); many of them report to the corporate chief executive officer, while some are at a low level on the organization chart.

New-product development is a multilevel activity in most companies. The companies that have new-product activities only at corporate level are mostly small, mostly nondivisionalized. The ones that have such activities only at division level are mostly diversified and decentralized. The activity may fall under any one of several functional headings—technical, marketing, or some special designation, like "commercial development." In virtually all the companies studied, new-product activities are present in both marketing and R&D at one level or another—or more than one.

Where Product Development Fits

The trend to decentralize organization structures has affected new-product development. Decision-making authority has been handed down from corporate level to groups, divisions and business units. Responsibility for manufacturing, marketing and sales has gone with it. With the exception of the financial function (which remains as centralized as ever), research and development is the activity that has resisted the decentralization trend most frequently.

Typically, in the reporting companies, the focus of marketing activity is in the operating units, while R&D tends to be split between the operating units and corporate headquarters. New product development also is typically split—with operating units (the ones that do the marketing and sales) handling development work close to the ongoing core businesses, and corporate working on "brand new" products that do not fit easily into the operating units.

This split is a natural response to one of the dilemmas of product development. The most logical place to get new ideas for improvements in product or for new models designed for the same market is the customer. The most logical point of contact with the customer would seem to be the sales force; and product division marketing the most logical collection point for these ideas.

But the logic breaks down when a company is developing a "brand new" product: one that will sell in a new market, or one that will employ a new technology that the operating unit is not equipped to service, or one that may boost profits like a rocket in five years but will mean nothing but hard work and red ink for the first three or four. As a practical matter, development of products like these is not likely to get a high priority in the operating units—where managers are already working 60 hours a week keeping up their ongoing businesses, putting out fires, and seeing to it that the current month's bottom line will be written in black ink.

An industrial equipment executive provides an example. In the late 1970's, his company's R&D laboratories developed a new technology that made it possible to do the job of some of its existing products more efficiently. The firm patented the technology, invented a machine to exploit it, and turned the project over to the appropriate operating division for development and commercialization.

Several problems arose. The new machine developed some "bugs" that required engineering work to remove. It used

Table 1: Organization Level of New Product Activities (N = 177)

Level	
Corporate and Division	45
Corporate only	25
Division only	24
Corporate and Group	10
Group and Division	8
Group only	2
All three levels	63
	177

Table 2: Executive with Principal Responsibility for New Product Development (N = 161)[a]

Technical Titles	
V P R&D or Engineering	52
Vice President Technical	13
Director R&D	5
President R&D	2
Senior V P R&D	2
Director Technology	1
Manager Engineering	1
	76
New Business Titles	
S V P (Product or New Business or Corporate Development)	2
V P (Product or New Business or Corporate Development)	8
Director (Product or New Business or Corporate Development)	13
Manager (Product or New Business or Corporate Development)	13
V P Corporate Development	3
S V P Corporate Development	1
V P New Ventures	1
	41

General Line Titles	
President	5
Chief Executive Officer	4
Vice President	4
General Manager	4
Executive Vice President	3
Group Vice President	3
Chief Operating Officer	1
Business Unit Manager	1
Department Director	1
	26
Marketing Titles	
Vice President Marketing	5
Director of Marketing	5
Senior V P Marketing	1
Vice President Sales	1
Marketing Manager	1
	13

[a] 3 companies report "joint" or "shared" responsibility; 2 report "nobody."

a different process—which was more complicated and harder for operators to learn—from the machine it replaced. The salespeople—familiar with the old machine—found the new one more difficult to sell. Introduction of the new product was much less successful than had been anticipated.

Recovering from its initial disappointment, corporate management finally decided to pull the new product out of the operating division and form a small group at corporate level to perfect it. A project team was set up, led by the inventor and including some of the people from corporate R&D who had been working on solutions to the problems. The team included representatives of marketing, engineering, sales (for training), and an applications lab.

The project team simplified the machine's operation, trained the salesforce in its use, and decided to concentrate its efforts on one application—the one the members judged the easiest to sell. When they reintroduced the product, it enjoyed the kind of reception that the company had hoped for.

As noted, most of the companies studied routinely break down product-development work between operating units and the corporate level. A large electrical manufacturing company's corporate technical officer explains that new product development has four quadrants, as the accompanying diagram shows.

IV New Product, New Market	I Present Product, Present Market
III New Product, Present Market	II Present Product, New Market

Table 3: Titles to Which New-Product Development Reports (N = 160)

Line Titles		*Staff Titles*	
President	46	Senior V P Technical	6
President & CEO	13	V P Operations	5
Division General Manager	11	Vice President R&D	5
Group Vice President	11	Chief Technical Officer	2
Chairman & CEO	10	Vice Chairman	2
Executive Vice President	9	V P Development	2
Chief Executive Officer	8	V P Enginerring	2
Division President	5	V P Planning	2
Vice President	5	Director of Research	1
Board of Directors	4	Exec. V P Operations	1
Group President	2	Mgr. Product Applications	1
Managing Director	2	Marketing Manager	1
Senior Executive V P	1	Senior V P Operations	1
Senior Vice President	1	V P Marketing	1
	128		32

I (present product, present market) includes normal evolution of the product (modifications) and normal evolution of the markets. It is usually left up to the operating units.

II (present product, new market) also is usually left to the operating units, although this executive thinks that sometimes the divisions assume they can cope with new markets better than they really can. "Actually, product development costs are usually exposed, while market development costs often are buried."

III (new product, present market) causes corporate to ask the operating unit if it is prepared to develop the new product, if it can cope with the technological problems. Often the answer is "No." Then corporate must study the situation carefully to find the best way to proceed, using a mixture of divisional and corporate resources.

IV (new product, new market) is always directed from corporate level. In this company, the vehicle most commonly used in carrying out the development is a task force of limited duration. Members work only part time, following a specific charter, and are often told to come back with a recommendation in 60 days.

The person with main responsibility for a new product's development usually reports to an executive at a high level, in some companies the CEO (Table 3). Whether or not this happens, the product development leader must have the CEO's backing if much is going to be accomplished. One conclusion that flows clearly from this study is that new product development is most likely to flourish when the function is plugged in, one way or another, close to the top. Asked where the product development function should ideally sit, one middle manager replied: "On the right hand of God."

At Brunswick Corp., where all the product development work is done in the divisions, the program is orchestrated by a Vice President-Technology who reports to the CEO. This vice president does not, and cannot, tell the division general managers what to do. But his position and the CEO's commitment to new product development ensure that ideas for new products will get immediate and sensible consideration, while the division general managers continue to devote their main attention to the vital job of running their divisions profitably.

At Monsanto Co., a Vice President reporting to the CEO acts as "godfather"to all the new-business-development people in the operating companies. His "club" is informal and unofficial, composed of the "commercial development skill base" of people throughout Monsanto. Through periodic meetings of the "club" and frequent informal contacts, he tries to provide them with motivation and leadership.

He sees the role of commercial development as two dimensional. When scientists in the research laboratories "manipulate molecules" to make a new substance, it is up to CD to turn it into a product—by testing, specifying and seeing that all the detailed steps from lab to market are done right. When marketing identifies a customer need, it is up to the CD person to determine how the company's array of scientists can fill it, and if the attempt is worth making.

In companies where this role is played by a junior manager, new product development does not receive much priority, and not much gets done. Sometimes such a manager actually performs the liaison between research and marketing, even though it is not really his job. This can be better than nothing, but the people who do the job "without portfolio" have two things in common—a sense of frustration, and the strong feeling that the job could be done better by someone with "clout."

What Kind of Function?

As Table 4 shows, new product development activities can fall under several function headings. As the table fails to show,

Table 4: Functions Carrying on New Product Activities (N = 177; multiple responses)

	Marketing	R&D or Technical	Special Commercial Development Unit
Corporate	56	107	54
Group	52	58	25
Division	100	103	41

the units that fall under R&D, marketing or special commercial development departments all try to do essentially the same thing— bring together the different talents and resources necessary to find new ideas, evaluate them in the context of the company's operations, and coordinate the development of a new product—through design, testing, pilot production, until it is sold commercially.

Wagner Spray Tech, Minneapolis, relies on its Vice President R&D to stimulate new product development. Yet the task is not his alone. Research is located close to the marketing department, to promote interaction between the units. When anybody has an idea, it is talked over informally with associates in both disciplines.

At one metals company, the locus of new product development has shifted from marketing to technical on the organization chart, but the effort has not changed much. Years ago, according to an executive, the company was "marketing driven" and proud of its technical service capability. When a customer said "we need such-and-such," engineering drawings would be there two weeks later. But a profit squeeze and personnel cutbacks reduced marketing to bare bones, concentrating on selling what was already being made. Now the Vice President, Corporate Quality Assurance and Technology, is moving to recreate the old orientation, but it is being done in the technical department. Today the company's new-product-development effort could be called "research driven," since 85 to 90 percent of the ideas come out of R&D, but it is still oriented toward the market.

The traditional commercial-development role is played by a person with the title of Manager, Planning & Administration, Corporate Quality Assurance & Technology Operations. This individual and a small staff do market studies, economic analysis, stay in close contact with the operating divisions, and go out and talk to people in the market. When one of the staff has an idea and the economics are favorable, he talks to division marketing and manufacturing, to see if the company can make it profitably. This preparatory work is so thorough and involves so much talk and study before consensus that acceptance of the product by the organization is almost automatic. After consensus, all pre-plant work is funded with research funds.

In some companies, the work is focused under marketing. This seems to be true most often in consumer products companies. But firms with high technical content, whether they make consumer or industrial products, tend to move the product-development function out of marketing and into special development units after a time. One instrument company's executive reports that the marketing people make the development decisions, but sometimes lack the technical knowledge to make the best decisions.

A chemical company illustrates the evolution of the development function through marketing to a special business-development unit. Until recently, corporate marketing had the job of finding the "synergies" between R&D and sales: R&D reported technological advances; sales reported which customer was trying to do what; and marketing spawned product developments when they seemed to make sense, nurtured them for a brief period, until they were judged to be capable of standing alone as independent business units reporting to the CEO. This system has now evolved a step: Marketing has been decentralized to the business units, and the marketing VP has been named head of a special business-development unit that does the spawning and nurturing.

Corporate planning is the organization function that contains Koppers Co.'s main development thrust, the venture capital company Kopvenco. Westinghouse spawns its capital ventures in R&D. At Toledo Scale Division of Reliance Electric (itself a subsidiary of Exxon Corp.), the New Products Manager is under marketing, but could just as well be under engineering, where the position was until 1978. The New Products Manager is equally at home with both and acts as a link between them.

In recognition of the position that new product developers occupy—"with a foot in each bucket," technical and sales—a number of companies put them in a special unit with strong dotted-line relationships to both marketing and research.

Divisions in the Chemicals Group at Air Products and Chemicals, Inc., are generally organized into business areas, with product management and marketing functions in each area. Before 1981 in the group's Industrial Chemicals Division, each constituent strategic business area also had a small business-development function that often received insufficient support and attention from the business area manager, who was occupied with near-term operating matters. In 1981, all division business-development personnel were transferred into a new Commercial Development function that was assigned to a director who reported to the Division Manager-Vice President. In 1985, the director was also given responsibility for the division technology function. This organization permits the director to infuse the benefits of both "market pull" and "technology push" into the programs. He feels this organizational structure helps him define more productive areas of research and move new products through the innovation pipeline more efficiently.

No matter where the box falls on the organization chart, the person who implements development tends to combine several functions. More often than not, he or she is a technical person who acts like a marketer, or a marketer who appreciates and understands the technology. Where that individual is placed in the organization seems less important than having both qualities and being in a position to exercise them.

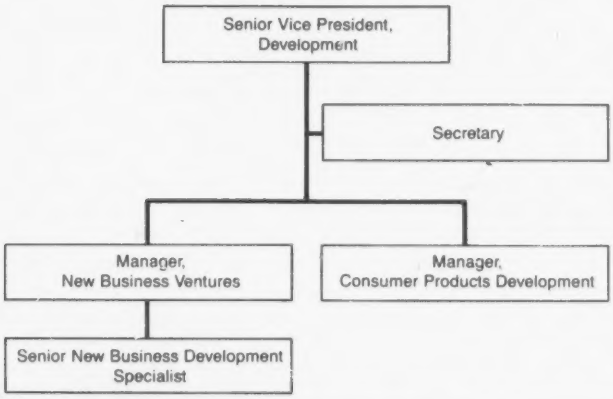
Forms of Organization

Diversity is the most striking feature of organizations for development of new products in the companies studied. Some development units are large; some are small. Some are formally structured, some informal. Some are permanent, some temporary. It seems that product development is one activity that nearly all companies approach pragmatically. There are no "school solutions" and few standard industry practices.

Exhibit 5

Pennzoil Products' Development Division

1986 Organizational Chart



A few of the companies have large organizations, spread through several levels, with substantial resources at their immediate disposal. Once Dow Chemical Co.'s top management decided to diversify for growth and to pursue market-driven specialties, it drastically reorganized the company. In 1983, all basic commodity-type chemicals were combined in one group; and a second group was created, mainly concerned with industrial specialties and services.

Central Research (450 people) was reorganized to focus on selected areas for new product and technology development. In addition, about 15 percent of the people in Dow's five Applied Science and Technology Labs were assigned to new product work. A small organization, the Innovation Development Department, was created to speed up commercial development of products that do not fit easily into one of the existing product departments. A corporate-level group, Discovery Development, was formed to direct early development of projects that do not fit existing commercial categories. Special commercial development units were formed to nurture projects close to commercialization but not yet ready to stand alone. And seven commercial directors were named to speed up commercialization of specialty products.

When Dow decided to attack electronics, it appointed a Business Development Manager and two Electronics Industry Development Managers, one on each coast, to get familiar with the market and communicate with people throughout the Dow organization. In June, 1985, it formed an Electronics Business Unit, combing several activities from various product departments serving the electronics industry. It will be the nucleus to develop and commercialize new electronic chemicals and materials not aligned with current product department thrusts. The unit is fully staffed, with its own technical service and development, marketing and sales people.

In contrast, ICI Americas has a new product-development unit consisting of one manager and two assistants—all very experienced—to handle applications in the U.S. market of ICI technologies developed abroad *plus* any other technologies that look promising, but are not exact "fits" into an existing business area. (See page 50.)

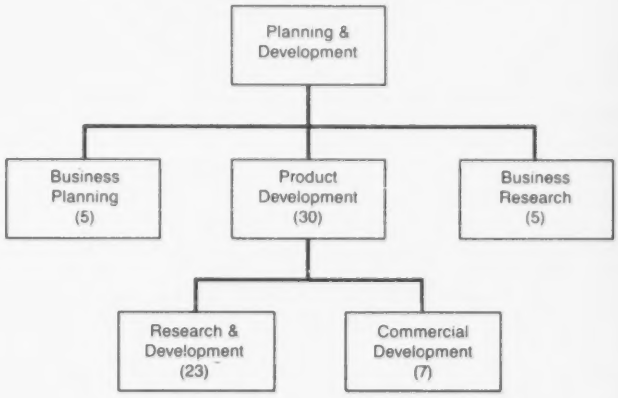
The organization of Pennzoil Products' Development unit (consisting of four professionals and a secretary) is shown in Exhibit 5. Its mission: "To act as a leading and driving force behind new-to-the-company business development . . . [and] to provide assistance, counsel and training to the operating units in their development of close-in product line extensions, new products, and new markets for existing businesses. The group also coordinates all high technology content acquistions, joint ventures, and licensing activities of Pennzoil Products Company."

A few companies have engaged consulting firms specializing in organization to design new-product-development units for them. Some of these are fairly elaborate and formalized structures. One producer of specialty papers asked such a firm in 1977 to lay out a road map for restructuring the company. The paper company then created the Planning & Development Division (Exhibit 6). Business Planning charts the course; Business Research evaluates potential acquisitions and does market research. Product Development, the largest part of the new division, includes both R&D and commercial development. It works closely with sales, providing the technical capability required to design new products to meet clearly identifiable customer needs. The organization works well, partly because Product Development has a budget that permits it to pay its own way in intracompany transactions (like buying machine time from manufacturing). This helps avoid conflicts with manufacturing, which is always under pressure to control costs, downtime and out-of-specification product.

In contrast is Toledo Scale, whose new-product-development organization consists of an engineer assigned to Marketing and a New Product Advisory Team that meets

Exhibit 6

Planning and Development Division: A Specialty Paper Company



three or four times a year, but talks frequently on the telphone. The team includes:

(1) A regional manager, responsible for sales and service in the Chicago region (encompassing several states);
(2) A district manager, from another region;
(3) A district manager, from a third region (the West Coast), who is also a service representative;
(4) A salesman, from the New York City market;
(5) A distributor—an independent businessman (Toledo's distributors are not necessarily exclusive): *"We've got to* make them *want to sell our stuff!"*;
(6) A distributor's representative, a woman who is strong in training and customer contact.

The idea behind this impromptu system is to pump good and timely information in from outside, so that engineering will be more likely to "get it right the first time." The team provides a mixture of viewpoints—by geography, by level in the sales chain, and by personality. The members pick up ideas, exchange them, and provide a good channel for bringing together the customer and the research lab.

Many of the new-product-development organizations encountered in the study are expected to endure—at least until the next reorganization. But others approach development purely on an ad hoc basis (as described in the previous chapter). Some count on champions to come forward with ideas and, given some support, to find ways to develop them into products. Others establish temporary project teams—composed of the best people available for a particular task—and turn them loose with a mission to come back with something valuable meeting the specifications. "Like Jason and the Argonauts, after the Golden Fleece," one executive suggested. And, like the Argonauts, these directed project teams often do bring home something worthwhile.

Transitional Organizations

A problem that occupies many executives charged with new product development is how best to get a promising new product launched successfully into the highly competitive environment of the marketplace when it has not yet proven itself profitable. The new product not only has to compete against competitors outside the company for market share, but it has also to compete for the time and attention of its own salespeople and managers.

As long as the new product is very much like the old ones—an "enhancement" or an "improvement" on the old line—it is easy to assign it to an existing division or business unit. But if the new product brings new requirements with it—different markets, different engineering problems—it has a good chance of being treated like an orphan. Marketing and sales will not knock down doors for the new product when they already have plenty of assured, established old products to sell. Managers, already working at capacity, hate to interrupt routine for something difficult and seemingly not very productive.

Several companies have created protective environments to solve this dilemma. Although they let the operating groups or divisions develop their own product improvements, they draw the line at new developments that stray very far from the operating unit's core business. "New" new product developments are assigned to a special development nursery, usually under the wing of corporate headquarters.

At W. R. Grace & Co., new business opportunities are nurtured by placing responsibility for their early development in the corporate Research Division, which is augmented by a small commercial development unit called Commercial Planning. The operating units are left to handle improvements and extensions, which Grace refers to as "short-term" R&D.

From the outset, corporate R&D works closely with the appropriate division. They review projects together formally once or twice a year as to objectives, progress and future plans. Reports go back and forth monthly to corresponding people at different levels. Division typically provides most of the interaction with users, the customer feedback.

For an idea to work, the division ultimately must adopt it as its own. Corporate must bring it to the point of showing its feasibility to the division—sometimes all the way through pilot phase in the rare cases where the division is skeptical. Typically, though, Commercial Planning and the divisional marketing and development people work closely and harmoniously, turning the project over to division at an early stage of market development. Then the division sponsors the project, appropriates the capital, and builds the plant.

This system of checks and balances gives corporate ample opportunity to develop new products and ample time to demonstrate their value to the operating divisions. It also recognizes where the ultimate profit responsibility will lie, by leaving the final decision to commercialize the product up to the division manager who will make and sell it.

At another chemical company, new product developments based on polymer technology are nurtured in a cost center run by the Director of New Products, who reports to the Vice President R&D. Although the group is built around research people, it also includes market development, applications development, and marketing specialists.

Under the eyes of a steering committee composed of three operating-division presidents who fund the group's activities, the director can evaluate and modify new product ideas, test market, and —with steering committee approval—build pilot plants before the projects earn a dime. The key to success in this arrangement is that projects must be justified continually to the committee, by detailed progress reports from the director.

A few of the projects are approaching commercialization. The plan is to start commercializing them in the cost center, and to transfer them to an operating division when they begin to make a profit. Until that time, the director will also handle sales; for products not much like those presently sold in the division, this means adding salespeople to the group.

Case Brief

PQ Corporation and the Brewing Business

Some years ago PQ Corporation was offered a license by an overseas firm for a protein adsorbent derived from silica gel. PQ had been searching for a niche in this product area, when the idea came in over the transom because of a long term relationship between the two companies.

The product was used in the brewing industry to adsorb certain proteins that cause chill haze in beer. Under the license, PQ would make and further develop the product and take over the U.S. accounts, which would serve as a base for further penetration of the U.S. brewing market.

Since it was a brand-new product for the company, PQ turned it over to the Commercial Development unit, a cost center reporting to Corporate Development, where new products could be nurtured for a time prior to their acceptance as self-supporting businesses in one of the operating divisions.

PQ had no sales force calling on breweries, so it took on as sales agent the licensor's U.S. distributor, an old agency well established in the brewing business. The agent introduced PQ development people to the brewers' technical staffs on joint sales calls—the agent providing the knowledge of brewing and PQ the chemistry knowledge.

PQ's projected sales for its first year of operations fell well below the original forecast, but the project continued. Since its status under Corporate Development did not require it to support itself, the loss of sales did not kill the project, but caused PQ to intensify its marketing efforts.

Since it was a licensed product, PQ's process R&D people were not involved very much in the basic product development, beyond formulating material from the licensed process. Instead, they took on a technical service role to handle the applications development. The sales agent had its own pilot brewery, and more advanced applications development was carried out in the customers' breweries.

A second snag in the adsorbent's development arose from the differences in culture between the chemical industry and the brewing industry. PQ's experience in chemicals technology prepared it for a logical and scientific use of the adsorber to clarify beer. PQ's process had a demonstrable advantage over other processes, and also had the advantage of being a "natural" step in the brewing process, rather than an "additive," which then proposed FDA regulations required to be posted on the label. But the brewing industry considers its manufacturing process more an art than a science. The brewer's main concern was what effect the protein adsorption process might have on the taste of the beer; and this required "many, many" taste tests and reformulations before brewmasters in each customer company were ready to accept this new method.

Three years after plant start-up PQ won over several key accounts to protein adsorption, and the new silica gel adsorbent was ready to be commercialized. The product was transferred out of Corporate Development, where it had been protected during its long start-up phase, into the Specialty Chemicals Division's Performance Products business unit. It was added to the division's product line and made the responsibility of its general manager.

The PQ commercial development people stayed in Corporate Development and turned their attention to new projects. The sales agent stayed on, with its new contact point being Performance Products marketing.

Performance Products was responsible for manufacturing and engineering. As a fully commercialized product, the protein adsorbent now had to stand on its own feet, measured against other products on the basis of return on assets in the internal competition for funds.

Eventually the whole project—engineers, salesmen, and all—will be transferred to a division.

Halfway Houses

As long as all the development work is technical, R&D is a logical place to lodge new-product development operations. At some point along the road to commercialization, however, marketing considerations often become more important. Some companies cope with this by designing an intermediate stage in the development process.

Phillips Petroleum has such a "halfway house" in its early stages of operation. When a development in R&D looks promising enough, a Business Development Team is appointed. Initially, the team is mainly concerned with research—developing a material, improving its characteristics—and it operates out of R&D. In time, the team must show management that its product is worth the investment necessary to put it on the market. When the team reaches the point where marketing considerations become more important than R&D, and it is necessary to talk to customers to see if the team can function in a business environment, it will be taken out of R&D and assigned to an Executive Vice President. Under him, the team will be evaluated as a potential business, but not held to the standards of short-term accountability that prevail in the product groups. There it will stay until it can stand alone as a business.

Phillips is working on the rules and specification for the "halfway house." When will a team enter? When will it leave? What are the criteria and the requirements? Management doesn't want the "halfway house" to be a receptacle for sick businesses from the product groups, nor for projects "that R&D doesn't have the guts to kill."

The "halfway house" has no staff, and will not have until three or four teams are assigned. Should it become necessary, an intermediate headquarters may be assigned.

PQ Corporation also has turned to a multi-stage approach to commercializing new product developments. Five years ago, PQ had a commercial development organization, reporting to the Vice President Corporate Development, in which a Commercial Development Manager supervised a portfolio of projects, each managed by a project manager. The project manager was responsible for R&D, market research, market development, engineering—everything up to the point where the plant was up and into production. At that point, the project would be transferred to an operating division. Sometimes the project manager would go along into the division, sometimes not. Research and engineering usually stayed behind. Manufacturing never was a responsibility of the project manager.

A problem with this system was that the transition from project to full-scale business was abrupt. While the commercial development environment nurtured future growth, the operating environment emphasized current return on assets.

To ease the transition, PQ has increased the responsibility of the project manager and made the shift a two-stage process. Now exploratory concepts are pursued directly under the Vice President Corporate Development. When a concept appears promising enough to assign people to develop it, it becomes a "venture." The Venture Manager has all the responsibilities of the old project manager (R&D, marketing, engineering) but also is responsible for manufacturing. He is expected to manage the venture all the way to commercialization and full production and beyond.

Initially he reports to the Vice President Corporate Development, where the venture is treated much the same as it was under the old system during the research, engineering, and market development phases. When the venture reaches production—when the capital is approved to build the plant and it is on its way to being an ongoing business, but not necessarily a profitable one—it is moved out from under the Vice President Corporate Development and assigned to the Executive Vice President for Development, where it remains until it has proven able to stand on its own feet and earn an acceptable return on assets. At that point (which has not yet been reached by any of PQ's new standalone ventures), it may become a full-fledged division, reporting to the President, in which case the venture manager would become general manager of the new division. (For a specific example of new product development at this company, see case brief on page 59).

From Project to Product

No matter what kind of device is used to nurture a development project and to protect it from the harsh realities of the market and the bottom line, the time eventually comes when it must be plucked from the nursery and thrust into operations. Most companies in the study finally turn the new product over to an existing division or business unit. But a few count on launching it in a new division or business unit, often with the project leader becoming the general manager. And others play it by ear—deciding whether to turn the product over to an existing unit or form a new one when the time for decision arrives.

The most important determinant in the decision of where to put the new product is usually marketing. If an existing product division has a workable distribution network in place, if its sales representatives are already calling on the right customers, and particularly if the establishment of a new business unit would encroach on the territory of one that is already there, the existing unit will be the choice. It may be the choice even if none of these elements is present.

Examples of different approaches abound. At W. R. Grace, the Research Division can carry a development on the corporate books for a time but finally has to get a division to adopt it or redirect the research. Pennzoil Products tends to design its new products to fit into its marketing capabilities. The fuel additive, REGANE, fit neatly into the GUMOUT Division's outlets (auto stores, discount stores, retail chains, etc.) and required the same kind of market research, packaging, and advertising. Indeed, that is why Pennzoil took on the development.

PQ Corporation exemplifies the companies that aim to set up new units under the leadership of the new-product development task-force leader. And other companies play it by ear. A 3M executive points out that some people are good at starting businesses, while others are good at leading them. At 3M the career path of the good business leaders is through project management to division leadership of a new division created to capitalize on the success of a new product that he may have championed. Another path is for the "good developers" to be "recycled" so they can do it again, with appropriate recognition and monetary rewards.

In other companies, of course, there is no problem of "folding in," because the product is never assigned to a nurturing unit. A pharmaceuticals firm gives marketing the responsibility as soon as it recognizes a possible product from among the substances described by R&D; and marketing keeps the responsibility throughout the product's life. An executive explains:

"Marketing makes a strategic plan out 20 years or more. Marketing manages the budget, and its product managers manage the products. Research supports claims and improves product. Sales implements the marketing plan, and clears the shelves. Each functional group does its own job."

The same is true in the Glass Group at PPG Industries. (See case brief on page 44.) Once the idea for a development has been accepted by management, the task force or team that is given the job goes and does it. Funding is approved all the way to commercialization, and management is committed to the development. On completion of their work, members of the task force go back to work on other things. Because the idea is accepted by the operating group before it is developed, there is no need to nurture it during development nor sell it to the people responsible for running the business.

The companies that find no need to shield new product

development from day-to-day operations have an important characteristic in common. Their line managers realize that they must keep developing products (improving them might be a better word) *in order to* produce profits. There is apparently no conflict.

An executive of Amstar feels that those who worry about short-term profit pressure probably are conducting inefficient research. At Amstar, "whatever we spend money on will have immediate end use." He feels that most companies focus their efforts similarly. "Few companies can afford a Bell Labs," he says.

If a company is already in a growth business, it does not need to look for breakthroughs in technology to sustain its growth rate. So they work the claim, "stay close to home," improve their products, solve design problems as they go. For a small company, like BioPlastics, it is easy to design small incremental changes to satisfy customers—to improve, as well as invent to a need. But even companies in the upper reaches of the Fortune 500—so big that it would take a major breakthrough every year to sustain their growth rates—often pride themselves on their ability to make continuing advances in small steps.

Chapter 8

Expenditure and Control Issues

Although they recognize that the money to finance development of new products is generated by the operating divisions, most of the executives cooperating in the study believe that the product-development effort should be financed at the corporate level. The chief executive officer is seen as the chief custodian of the company's future, and so the funds needed to assure the future ought to be allocated by his office.

Some of the companies that appear to have the best records in product development have CEO's who hand out resources liberally. In some companies, this liberality takes the form of a loose and informal budgeting system. In others, budgeting is tight, but the CEO can and does relax the system when he thinks it justified.

A leading foods company funds its development task forces out of the budgets of the participating groups and divisions, which are ample for considerable amounts of research. Much of the work involves no out-of-pocket expense, but can be done by the task force members and their own staffs. But if out-of-pocket expenditures are required, "we find a way," an executive reports. In addition, the company's budgeted New Product Development Units, which operate much like task forces, have plenty of "seed money," not only to pay for in-house research, but also—as an executive says—"unless it was December, they'd have no trouble finding $75,000 for work by an outside consultant."

An industrial equipment company that recently has changed management and set its cap for innovation is described as being even more openhanded, at least selectively. "Under the old regime, it was hard to get a nickel," says an executive. "Now the Chairman's first question is 'What do you need?' "

A paper company R&D executive reports that although he has a budget, it does not matter if he goes over it as long as he can explain why. And a building materials firm sets aside 10 percent of each research lab's budget for freelancing, "which makes 'bootlegging' unnecessary," a research executive says. At this company, a laboratory can exceed its freelance budget by as much as 200 percent without criticism as long as it can justify the variance. "Nobody gets criticized for working on something good."

Koppers Co. runs its venture company, Kopvenco, in an unstructured manner. (See page 8-9.) Time is charged back and forth between Kopvenco and the other departments and divisions of Koppers, "but nobody worries much about it," a executive says.

At another company, the basic budgeting process is controlled very tightly—on the "loose-tight" concept. The development is done in the operating divisions, under loose control within budgeting guidelines. "The CEO is open handed when it comes to use of money," an executive says; "but he wants to know what's going on, and he expects the division managers to take ownership of their programs."

How Much for New Product Development?

This study has unearthed no hard and fast rules for determining how much money to invest in new product development. Some executives says they watch the percent of sales invested in R&D as an indicator, but all agree that there is nothing magical about adhering to a fixed percentage.[1]

The closest thing to a formula for allocating money for new product development came from an executive who was quick to point out that his company did not use it. He offered it as a way that *could* help quantify the need for development money:

(1) In its strategic plan, the company decides how fast it wants sales to grow during the planning period.

(2) Looking ahead at the life cycles of its existing product lines, the company projects what will happen to sales if there are no new products.

(3) By looking at the difference between the desired sales curve and the composite projection of product growth curves, one can tell how much added sales will be needed three years from now (or five years from now) to achieve the target.

(4) Based on its experience, the company then asks: "How much must we spend on new product development this year to develop that much additional sales of new products?"

[1] Corporate R&D programs typically embrace *process* innovations and improvements and, in some very large companies, fundamental research, as well as new product development. It is the last that is of concern here, of course.

Much more important than a formula or a pre-set percent of sales, executives point out, is management's commitment to keep research programs going in fair weather and foul. This commitment is the key to the climate for innovation at American Cyanamid, and a strong contributor to excellence in product development at other companies as well.

On the other hand, an executive tells the story of the mischief done when a recession caused unexpected cutbacks in the budget for a newly formed commercial development department. The department had been scheduled to add four people; but, as a result of the downturn, the CEO froze headcount and salaries. Nobody was upset about the salary freeze, but the headcount limitation was a costly mistake, his colleague says. "Our new department had been highlighted as a top-priority project—the key to the company's future. The headcount freeze flashed the message that management was 'all talk and no action.' As a result, I lost two good people. It's taken a while to get back on the track."

Negotiated Budgets

In many of the companies cooperating in the study, the level of spending for research and development is determined in negotiations between the product divisions and corporate R&D. Typically, negotiations start with last year's figures and go up or down from there. At Bethlehem Steel the R&D budget is charged to the operating divisions—directly for cost reduction activities and indirectly (by apportionment) for market-driven and new product activities. Negotiations generally start with the previous year's number and, depending on business conditions and market needs, adjust from that figure.

At a specialty paper company, the Product Development Group's budget is negotiated from the bottom up, based on changes from last year's levels. Although the group is not a profit center, the budget allows for paying the standard rate to manufacturing for machine time. This permits smooth relations with manufacturing and lets Product Development respond quickly to market needs when necessary.

At W. R. Grace & Co., the divisions negoitiate for corporate R&D *time,* rather than money. Divisions do their own short-term R&D to support ongoing businesses (improvements and extensions); while corporate Research Division does long-term R&D—60 percent to develop new businesses for the operating divisions and 40 percent to develop new technologies for totally new businesses.

The divisions are not charged for either kind of corporate R&D. This leaves corporate free to work on projects for the divisions which their preoccupation with day-to-day operations might otherwise cause them to overlook—or to throw out as being too expensive or too risky. The divisions actually compete for corporate research time. "Which projects corporate will undertake depends partly on the division's clout," says an executive from one division. "If I can explain why I'll lose $10 million in sales if I don't have a new formulation by next year, I'm likely to get it." Otherwise corporate R&D evaluates proposed projects against the criteria of risk and potential payoff. Although corporate funds the research, division eventually must pick it up voluntarily or the project will die. Division appropriates the capital and builds the plant. Whether by accident or design, Grace's system assures consensus—while also assuring that the divisions will not neglect new product development to the point where their growth grinds to a halt.

Approvals and Reviews

Several ways of blending research flexibility and operational control are reported. At USG, budgets for the corporate research labs are mostly charged against the product companies; and they must be approved by the company presidents as well as by the R&D chain of command. For both the annual budget and the long-range plan, the spade work is done by the lab manager and the appropriate product company's marketing manager, cooperating directly. When there is processing expense, the appropriate manufacturing manager also works on it. When approved by the funding company's president and the corporate vice president R&D (who works closely with the presidents), the budget goes to the Senior Vice President Science & Technology and finally to the Vice Chairman—who is ultimately responsible for R&D.

This system is accompanied by a liberal attitude toward administration of the budget. Each laboratory has 10 percent of its budget for freelancing, and can exceed that allowance by a large margin for a good idea. There is no problem getting research funds for a project to support a strong going business.

A chemical company supports it New Products Group as a cost center, paid for by three divisions whose presidents compose a steering committee for the group. The executive in charge of the New Products Group does his own planning and sets his own priorities, under the steering committee's general supervision. The committee meets for an hour or two each quarter to review the group's business, and the group's executive sends the members frequent progress reports between meetings.

The reports include extensive "process analysis"—examining the ongoing developments all the way from inception to commercialization, providing a good flow sheet and figures so that the committee members know as nearly as possible what a development will cost all the way until the product is on its own feet. The detailed reporting has helped provide an atmosphere conducive to innovations that range a considerable distance from the division's core businesses—in some cases even requiring consideration of new distribution systems.

Direct Charges: 'Pro'

A very common method of financing R&D is to charge the operating units for the amount of time they use. Proponents of this method point to its simplicity and its inherent

fairness. Some add that maintaining an arm's-length relationship between corporate R&D laboratories and the using divisions helps ensure the efficiency of the labs.

Glidden's technical managers' expenses are allocated by time sheet and charged either to the appropriate marketing managers (who are on the division staff) or to profit centers (which are segmented by geographic regions). The technical managers devote their time and resources to:

(1) Protecting existing business by solving problems at customer's plants;

(2) Developing and commercializing new products, technologies or modifications to existing technologies that require commercial success (a) within 12 months, or (b) in from 12 to 36 months.

The time sheets show allocation of time by market, technology, and type of work—protection, short-term development, or long-term development.

At PQ Corporation, Corporate Development is a profit center. It defines its own business objectives and sets up research, development and engineering programs on the basis of these business objectives. All profit centers budget and pay for R&D and engineering time as they use it.

Westinghouse's corporate R&D labs treat the business units as customers. The BU's contract with them for one-fourth of the total company-financed research done throughout the corporation. Corporate has the advantage of spreading depreciation over many users, permitting it to get more expensive equipment and people than the units could afford themselves; and, unlike a university or a not-for-profit research institute, it is sure to protect the BU's proprietary interest.

In many of the companies where R&D is charged directly to the operating units, practically all the work done is on product improvements. At one chemical company, for example, researchers in the central lab are encouraged to work closely with the operating units that use their expertise. Their time is charged directly and "up front," and they are looked upon almost as if they were on the business unit's payroll.

Direct Charges: 'Con'

Other executives hold the opposite view, arguing that the *worst* way to finance a development effort is to charge time directly to the operating units that use it: Often the result is that very little research is ordered by the units, and very little gets done. One chemical company executive recommended that his company scrap its new-product-development cost center several years ago in favor of a system of direct charges, but since then he has come full circle. Now he wants to add two commercial development people at corporate level, as a cost center funded by the office of the CEO.

The executive is counting on this move to get the company's product-development program "off dead center." The divisions are now too preoccupied with the bottom line to think far afield, and do not justify spending money to develop new products. "If the CEO wants growth, he'll have to fund it. And that's what we intend to do," says the executive.

A metals company has expanded and improved its product-development activity since its corporate technical department was shifted from direct charge to overhead status. Five years ago, funding for corporate R&D came 60 percent to 70 percent from the operating divisions. But management was convinced by the incoming Technical Vice President that good development required more flexibility, because the operating divisions, "in paying the piper, got to call the tune." The company was going through a period of budget tightening at the time; and as the operating divisions' budgets shrank, so did their interest in R&D. There was not enough money left to do the work that the Technical Vice President thought (and top management came to think) corporate R&D should be doing. His argument was that the divisions would have to pay for whatever research was done sooner or later, since they brought in all the money; but that they would have less influence over his research program if they were not always writing him checks.

So top management shifted most corporate R&D work to overhead status, rather than direct charge. Now the divisions confine their research to process development and trouble-shooting, and corporate does 70 to 80 percent of the R&D. Not even the work corporate does for the divisions is charged directly. Each year the divisions and corporate R&D negotiate and agree in advance to a figure covering next year's work. Then the divisions are billed one-twelfth of that each month.

The research manager keeps track of time and lets the divisions know when they exceed their allocation. When this happens, corporate funds are invaded for the rest of the year, but it leaves R&D in an advantageous position for next year's negotiations. Everyone understands that the money has to be earned by the operating divisions. The difference is that R&D is more independent and has more flexibility to do needed research.

This financial independence permits the technical department to drive a product development effort that is strongly market oriented and closely coordinated with the marketing and manufacturing plans of the divisions.

Cost Center versus Profit Center

Most companies nurture their developing projects by making them cost centers or assigning them to cost centers. But a few prefer to treat them like profit centers from an early stage, even though they do not earn a profit during their development phase.

A chemical company nurtures a new development for a very short time, then makes it a profit center reporting to the Chief Executive Officer. After Business Development has found a "nascent business" based on synergy between a technology reported by Research and a customer need reported by Sales, it appoints a Development Team Leader to coor-

Case Brief

'Printchem' Learns To Fly

Several years ago a medium-sized chemicals company made a study of promising growth areas and came up with a plan to get into printed-wiring-board process chemicals. It acquired "Printchem," a distributor of chemicals to the PWB market, as an entry vehicle and began buying technology to develop the newly acquired subsidiary into a manufacturer.

"Printchem" immediately ran into manufacturing problems. Quality was inconsistent; machinery broke down; unexpected glitches appeared in the process as it was developed. The parent had anticipated problems, however. The parent gave "Printchem" enough resources to experiment, make mistakes, and forge ahead. To control the flow of resources, the parent promised additional increments of money as milestones were passed.

When "Printchem" joined the chemicals company, it was sheltered under Commercial Development. In order to qualify for the money increments, however, it was expected to conform to corporate policies like the other divisions. Corporate vice presidents asked "Printchem" to make a five-year business plan.

Because of the amorphous market and their newness to it, the managers of "Printchem" found this very hard to do. The targets they set for sales and profits had little grounding in fact or experience. As a result, although "Printchem" was making real progress in solving its technical problems, it was being measured against the business milestones it never made. This caused morale problems.

"Printchem's" managers also were naive in working with competitors who were also their suppliers. When "Printchem" proposed joint research with suppliers to solve its problems, the suppliers refused because they did not want "Printchem" to learn their processes. As a result, the relationship with a leading supplier collapsed.

The situation worsened. Filled with doubts about its wisdom in having acquired "Printchem" in the first place, the parent moved it out from under the protective wing of Commercial Development and placed it in an industrial chemicals group. Nothing improved. Soon after, "Printchem" was spun off to a joint venture controlled by a smaller and somewhat more flexibly managed chemicals company.

Under this company, the fledgling operation found a different environment. The parent had no reason to treat "Printchem" like other business units—there were fewer of them, and each one was treated differently. No more five-year business plans; it made individual product plans. Instead of estimating markets they did not understand as yet, "Printchem" managers used their energies to develop a better process-control system. They began testing at customer sites, documenting results, learning customer reactions. "Printchem" also embarked on a plan to protect its own technology. It developed a patent portfolio on uses and processes, copyrights, and secrecy agreements; it limited its publications, made employee agreements on patents, kept its leading edge of technical knowledge under wraps. Thus it built up a valuable stock of proprietary technology.

Rather than strive for perfection, "Printchem" designed a simple product, then froze design. Initial pricing was set to be competitive. Redesign of a second-generation product and future pricing strategy will be based on actual customer experience.

Left to deal with their own problems instead of less pressing ones imposed on them from outside, the managers of "Printchem" have solved first the technical problems and later those of the market. They have rethought their initial strategy and come up with a better one—the proprietary chemistry and control system. They have learned about their customers, and are now ready to grow.

dinate the development. In the early stage, he gets support from wherever he needs it, informally and at no charge. The company is willing to spend money for needed equipment, lend skilled people, help in any way it can.

As soon as "there's enough definition for a budget—not just hope," the Development Team becomes a Business Unit. It is taken out of Business Development, told to report to the General Manager, and put on a budget. It becomes a profit center immediately, even though its first budget is in the red. From then on it is charged for services from the functional departments.

Rather than continue to nurture the development as a cost center, this company prefers to use the budget, which it refers to as "organized permission to operate a loss-generating business." The budget is red, but it's accurate. The leader is evaluated on the soundness of his judgment—not on numbers.

In contrast, a pharmaceutical company's chemical division sets up development projects as cost centers. There are two advantages: (1) it is a logical way to find out what the project costs; (2) it trains the project champion in managing a budget. This is helpful since he may become the manager of a Business Unit to make and sell the product once it has been commercialized.

Even after commercialization, the business unit may be protected from operating pressures for a time. For instance, a special business unit within the Chemical Division has its own technical people, its own sales force, and its own equipment. It has its own P&L and is headed by a general manager, whose job it is to "grow" the business and make money. But his performance measurement is "heavily weighted to the future," and not based on profit alone. Several of these infant business units are functioning in the division. Their general managers normally report to a vice president.

The cost center approach and the profit center business venture approach each has its advantages and disadvantages, says an executive experienced with both. With a cost center, there is less emphasis on results. This encourages risk taking, but a lot of money can be wasted in running after ivory tower ideas. "When research divisions are left alone, they spend much time on activities without markets, and portfolio project managers do not place much emphasis on bottom line results. "But tell them they are venture managers, and their focus changes: their orientation starts to shift. They think in terms of 'What's our net?' not 'How much money do we need?' In short, they start to take on the character of a division general manager."

Performance Versus Numbers

Many of the executives cooperating in the study make the point that budgetary and other management controls are not the best way to direct new product development. Too much reliance on numbers can lead to strategic mistakes. An executive of one U.S. company that is owned by a European company believes that U.S. top management tends to be more "statistically oriented" than it should be. "In some U.S. companies top management is happy to approve such-and-such a percent of sales for R&D—it's good public relations—but they don't really know what's going on," he says. "Our parent company in Europe considers proposals more on the basis of market evaluations and technical feasibility. It gets practical in a hurry."

The case brief on page 66 show how one small company's change from "management by the numbers" to more pragmatic direction transformed if from a loser to a winner. Many other executives emphasize that holding a fledgling business up to the same standards as a going concern can result in a high mortality rate among fledglings.

As a further illustration of the problems of conventional analysis, some years ago at General Electric Co., an executive reports, new products management did a discounted-cash-flow analysis on about a dozen R&D projects that were then in the works. The projects analyzed included artificial diamonds, the polymer research that led GE into that field, and several projects for the divisions. Only the diamonds came out in the black in the analysis—and just barely in the black. All the others showed as losers, even though many of them later were commercialized successfully.

One executive blames the standard cost-accounting system for retarding new product development, and for a number of other problems of U.S. industry, saying: "The system is completely antiquated, completely accepted, and completely wrong." At his company, the controller is working on a system to look at all functions at once and measure their true costs; but he is aware that this can not be accomplished completely. "The CEO is at least convinced that the present system is wrong; so rather than rely on numbers, he just uses his best judgment. With R&D investment, you just have to fly," he adds.

With present accounting practices, this executive recommends thinking in terms of two kinds of dollars—long-term and short-term. "Some kind of milestone measurement for payback is a step in the right direction, but most standards accept a three- to seven-year payback for R&D, and it never pays back that fast."

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